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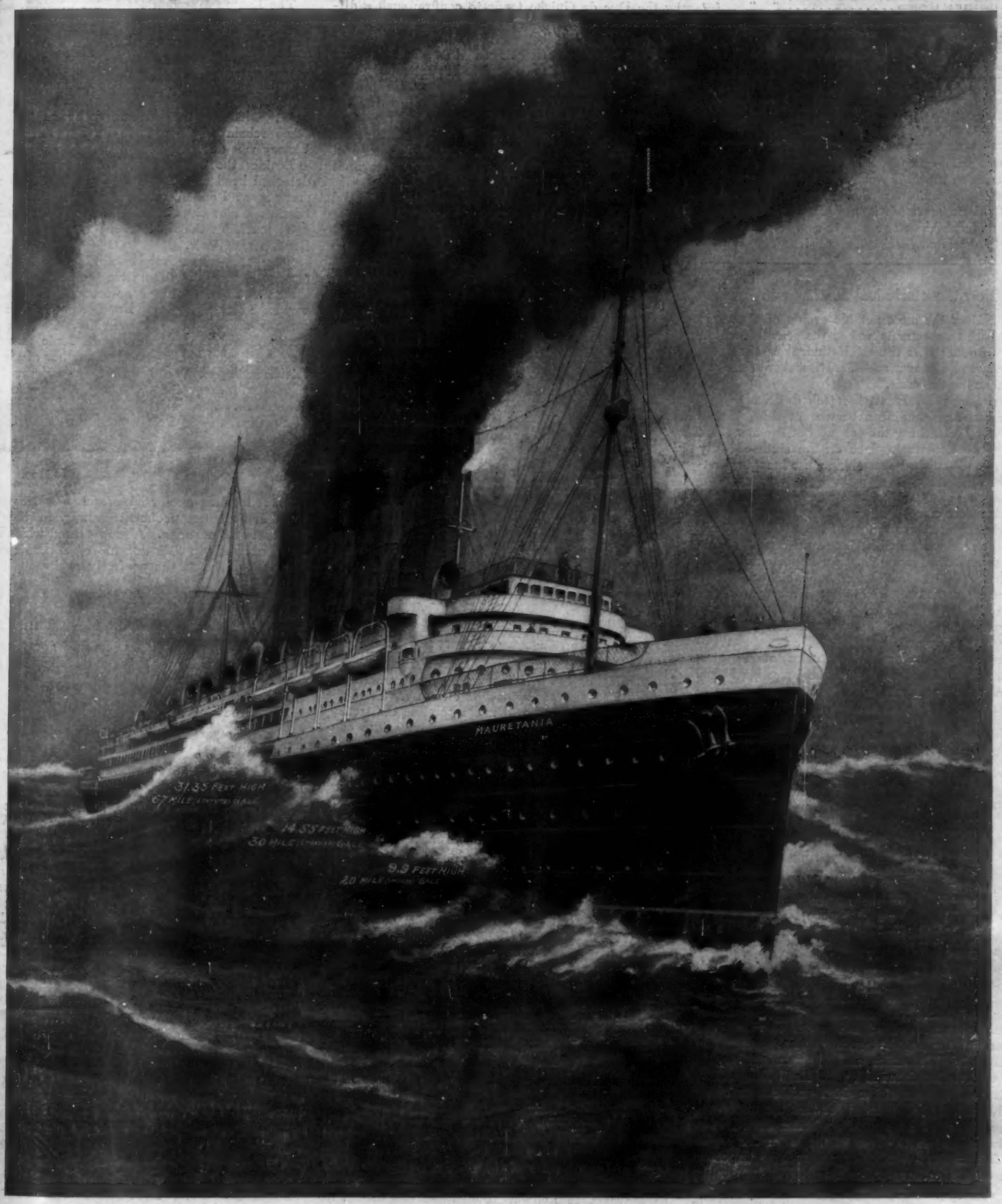

HEIGHT OF OCEAN WAVES AT VARIOUS WINDS COMPARED WITH FREEBOARD OF THE "MAURETANIA."—[See page 165.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

The New Aerotechnical Institute in Paris

ONE of the most notable events of the year, both to aeronauts and to the scientific world in general, is the establishment of the great laboratory to be known as "L'Institut Aerotechnique de l'Universite de Paris."

The donor is M. Henri Deutsch de la Meurthe, long known as a munificent patron of those daring spirits who are seeking the conquest of the air. The opening exercises took place on the sixth of July before a distinguished assemblage, the inaugural address being delivered by Prof. Appell, member of the Academy and Dean of the Faculty of Sciences.

The institute consists of an immense laboratory for the study of practical problems in aeronautics by the aid of the most advanced science and with an equipment as perfect as possible. An important feature is a track 4,593 feet long, on which specially constructed cars run, giving opportunity for the study of the operation of planes, propellers, and other parts of the machines when moving through the air at high speed.

There are associated laboratories of Physics, Chemistry, and Mechanics for the investigation of the materials used, with reference to such questions as their purity, durability, elasticity, strength, and resistance.

The services rendered by this remarkable institution will be twofold. In the first place there will be a permanent staff of investigators making methodical researches in the endeavor to ascertain the fundamental data necessary to aeronautical achievement. Secondly, the establishment will be open to inventors and builders of aircraft who wish to test their apparatus, and to makers desirous of trying out new ideas. Furthermore, all its resources will be put expressly at the disposition of officers and engineers designated by the respective Ministers of War, of the Marine, and of Public Works.

The plans have been conceived and executed by the well-known engineer, M. Hugon. Details of management, programs of experiment, and methods of research have been elaborated by a council composed of the founder, of officers and engineers representing the ministers concerned, of builders and practical airmen, and of competent scientists and members of the faculty, such as the professor of Experimental Mechanics and the nominee to the Chair of Aviation founded by M. Basil Zaharoff.

In a brief *resume* of the chief problems to be attacked, Prof. Appell pointed out that the motor was the very heart of all aircraft, whether dirigibles or aeroplanes, and in the case of the latter the slightest defect in this essential organ, such as imperfect action of the carbureter, or ignition or lubrication system, might precipitate a catastrophe. Hence there is special provision of a thorough equipment in the institute for the determination of the essential facts regarding motors, such as consumption of fuel, horse-power, revolutions per minute, etc.

Of almost equal importance are the propellers. Hence endeavors will be made to ascertain the characteristics upon which the propulsive power and efficiency of propellers depend, besides determining whether their action is the same when revolving in an artificial current of air as when driving a machine through the atmosphere.

"But the most important and as yet the most obscure subject of all," remarks Prof. Appell, "is Aero-dynamics itself. What are the laws of the resistance of the air? Can they be exactly determined by placing a plane in an artificial current of air as in the admirable experiments recently conducted by M. Eiffel? Or must we admit that the phenomena affecting the back of the plane differ according to whether it is placed in a current of air from a blower or whether it is driven forward in free air like the wing of an aeroplane? An experimental thesis recently presented to the faculty by the Duc de Guiche tends to confirm such a difference."

It will be an object of the institute to carefully compare such experiments as these, and the car running on a track is expected to be particularly useful in this connection. Besides a car for testing propellers there will be a second one electrically propelled, which will be used for testing full-sized aeroplanes, at a possible speed of 110 kilometers (68.3 miles) per hour. Registering apparatus will permit the measurement of the various pressures it is desirable to determine.

For experiments with smaller surfaces a special circular building, the largest ever constructed for this purpose, will be used.

These cars will be very useful to inventors who wish to test their devices. By placing the machine, or a reduced model of it, on the car, it may be seen at once whether practice confirms theory.

In the same way may be estimated without danger to the pilot the influence of the shape of the wings, of their angle of attack, of the inclination of the rudders, as well as the value of various passive resistances.

All these results will serve, as Prof. Appell points out, for the establishment of fundamental formulæ. "The general equations of the movement of the aeroplane have been given," he observes, "authoritatively by our colleague, M. Painleve (in his treatise, *On the Dynamics of the Aeroplane*), but they still contain many unknown coefficients.

"The determination of these coefficients must be made by careful experimentation. The experience of actual flight is too complex, as all the elements of the machine are operating at the same time, and it is hence impossible to study separately the effect of each of them. The method of the car, on the contrary, permits the analytic study of the individual role of each part, and the founding of the technique of the aeroplane upon a solid scientific basis."

One of the chief aims of this new research laboratory is the solving of the problem of automatic stability, which is the principal problem still remaining for the aeronautical engineer to clear up. The long track in the open air will make possible the testing of all sorts of stabilizing devices under actual conditions of flight, while similar tests on models can be made on the track within the circular building. A power plant of 200 horse-power furnishes ample electricity to drive the testing cars at high speeds.

The whole concept and execution of this great enterprise breathe a generosity and public-spirited endeavor creditable alike to the founder and to the savants associated with him. It cannot fail to be productive of results of great and permanent value in the new art of air traffic.

A New Relic of the Parthenon Gables

THE extant sculptures of the Parthenon, which the current opinion erroneously attributes to the great Pheidias, are distributed in four principal groups. Several fine horse heads of the east gable and two coupled human figures of the west gable remain *in situ* on the front and back cornices of the famous temple. The building retains, also, the twenty-eight mutilated metopes of its exterior, Doric friezes at front and back, and the sixteen very slightly injured relief slabs of its low relief Ionic frieze at the west end of the temple, where the procession of Athenian horsemen is still forming. Lord Elgin's Italian agent Lusieri spared some additional blocks of both friezes on the long north and south sides of the ruin, when he threw its cornices down to free and extract the sections which he conveyed to London through the vicissitudes of the Napoleonic blockades. It will be remembered that Lord Elgin himself was held prisoner in France for a season. But only one of his consignments of Athenian marbles was captured by a French frigate. The Scotch earl's generous rival, the Marquis de Choiseul, purchased and returned this to its British owner without charge. Part of the broken but superb torso of Poseidon, another torso supposed to be Prometheus, and the semi-figure of the moon goddess Selene driving her steeds into the brine are among the Parthenon marbles preserved in the Akropolis Museum. Another is the splendid frieze block with the sacrificial cows, which Count de Laborde excavated at the foot of the temple in 1840. A more recent excavation at Athens resulted in the recovery of the head of Hebe from the east frieze. Athens has never yet forgiven Lord Elgin's capture of the major part of its Perikleian inheritance in carven stone. The Elgin collection became the property of the British nation for 36,000 pounds sterling in 1816, and has been the British Museum's most priceless of art treasures ever since.

The Louvre Museum, across the Channel, has the single slab of marching Athenian maidens which Choiseul secured. It is likely enough that France and not England would have got the whole treasure if Nelson had lost the battle of the Nile in 1799. The present Duc de Laborde has a fine female head from one of the Parthenon pediments at his Paris *hotel*. This relic reached France by way of Venice. Some scholars believe it to be a remnant of the Victory who drove Athena's car in the west gable.

Besides the Choiseul slab, the Louvre owns the detached head of a Lapith from one of the centaur metopes at London. An American specialist, Dr. Charles Waldstein, first fitted the two together.

So much for the Parthenon sculptures at Athens, London and Paris.

Very few other fragments of the world's most renowned group of decorative sculptures have been located. The celebrated horseman of the Vatican was once classed as one. But it was only the tombstone of some Athenian roughrider. Palermo has a pretty fragment of the eastward Ionic frieze; the Duke of Modena at Vienna has another of the south frieze; a third frieze fragment was recovered from a garden rockery in the north of England a few years back. Carlsruhe and Copenhagen have pieces of Parthenon metope slabs from the Doric frieze of the temple.

Dr. Jan Six, the son of the Amsterdam medalist, and a descendant of Rembrandt's familiar Burgomaster Six, has the merit, and the rare good fortune, of locating a very important, new fragment of the Parthenonian pediment groups, in the Royal Museum of Stockholm. A female head which he has just published in *The Journal of Hellenic Studies* has hitherto borne the perfectly arbitrary name of "Dejanira." The Stockholm marble has the same characteristic blocked modeling as the badly weathered head of the London "Theseus," and that statue is the only complete pedimental figure with a head on its shoulders. The new marble agrees, in this resemblance, with the Duc de Laborde's female head. This *air de famille* is, indeed, the clinching argument for the attribution of both the detached heads to the studio of the Parthenon sculptors. For of heads and statues chiseled over life size in Pentelic marble there are many. It is the eye that must decide. Kalkmann and other classical archæologists have enriched the machinery of their favorite science with tables of comparative dimensions which are a lame substitute, at best, for the immediate perceptions of that sensitive organ. We suppress the dry figures in the present case.

Persons familiar with Anna Akerhjelm's letter to her brother Sam, containing a contemporary account of the explosion and wreck of the Parthenon by a Venetian shell, in 1687, will find the Dutch critic's lucky location of a trophy of the fall of Athens in Sweden no more surprising than Weber's purchase of a similar one at Venice. Anna was a Swedish companion of Countess Konigsmark on board of Francesco Morosini's squadron. Count Konigsmark himself commanded a force of Hessian mercenaries under Morosini. One of his Germans pointed the fatal mortar which compelled the Turkish garrison's surrender of the citadel on September 28th of that year. A deserter had brought Konigsmark the information that the great temple was the enemy's chief casemate and powder magazine. Three hundred souls lost their lives in the historic explosion. The number included the harem of the Turkish commandant.

One may indulge the fancy that Sam Akerhjelm's sister carried the Stockholm head to Sweden, just as some other follower of Morosini must have taken the Weber-Laborde head to Venice. As a matter of record, the broken Greek head was in a collection made at the royal Swedish castle of Drottningholm by Frederick the Great's sister Queen Louisa Ulrica of Sweden, before her accession in 1749.

William Napier Shaw, F.R.S.

The Head of the Official Meteorological World

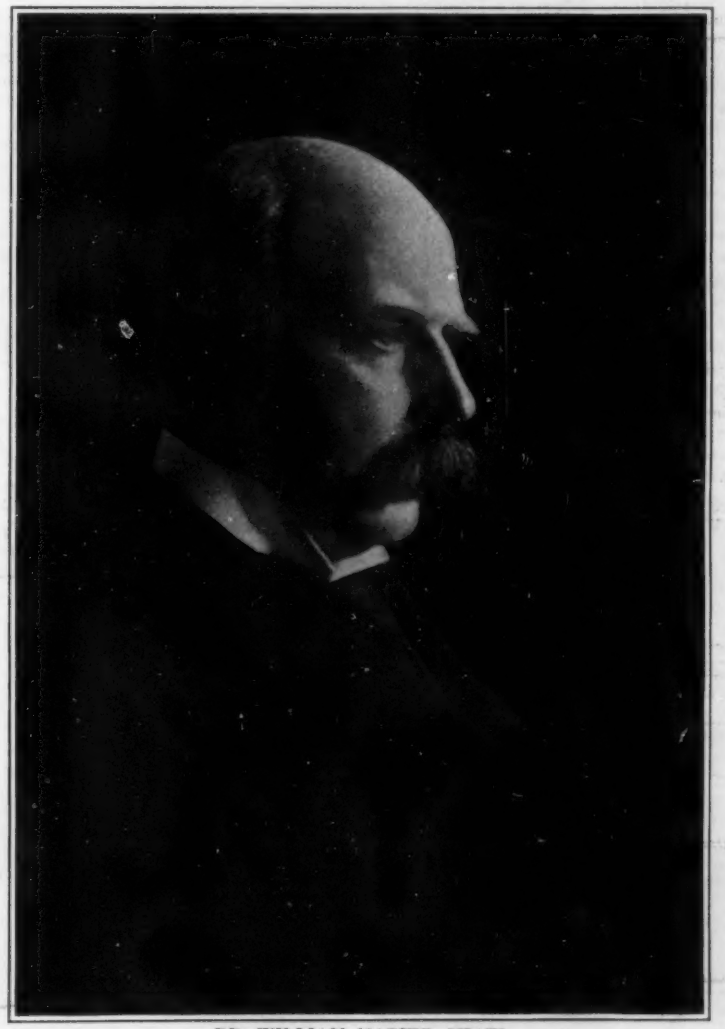
By C. Fitzhugh Talman

WHEN the lamented Mascart, shortly before his death in 1907, relinquished the presidency of the International Meteorological Committee—an association comprising the directors of the principal national weather services of the world—the choice of his successor entailed no delay or discussion. The committee was singularly fortunate in having among its members a man ideally fitted to occupy the by no means easy position of head of official international meteorology. Others had contributed more conspicuously than Dr. Shaw to the advancement of the world's knowledge of the atmosphere; but no one even approached him in those personal qualities that stand for successful leadership.

Dr. William Napier Shaw, president of the International Meteorological Committee and director of the British Meteorological Office, is a man whose personality compels attention. Physically, he is above the average in build and stature. Anyone who is prone to notice canine affinities in the human species would unhesitatingly class him among the mastiffs. Temperamentally, he is placid and self-contained, suave and tactful, under all the harassing circumstances that beset him as an administrator, national and international. Intellectually, he is the kind of man in whom we like to see the realization of the ideals of the English universities. His *métier* happens to be physical science; but this fact does not warp his appreciation of the humanities. In his public addresses he is prone to quote poetry. The quotations are always felicitous, and fit in quite naturally with the speaker's graceful prose, which has itself a poetical undercurrent.

Born at Birmingham in 1854, he was educated first at King Edward's School, in his native town, and then at Emmanuel College, Cambridge. His studies in physics were rounded out at the University of Berlin, under Helmholtz, whence he returned to Cambridge as fellow of Emmanuel, becoming later university lecturer in experimental physics, and then assistant director of the Cavendish Laboratory.

In 1885, after the introduction of "New Statutes for the University and Colleges," he married Sarah, second daughter of Dr. T. Harland, of Salford, herself attached to the teaching staff of the university, as lecturer in mathematics at Newnham. Mrs. Shaw has kept up her interest in educational matters, and is an active leader in the educational section of the British Association. She is also an ardent amateur photographer, and we are indebted to her skill in this direction for the portrait of her husband that accompanies this article.



DR. WILLIAM NAPIER SHAW
President of the International Meteorological Committee.

From the beginning of his academic career, Shaw displayed an interest in certain applications of physics to meteorology, and he carried out special investigations for the Meteorological Council of the Royal Society long before he dreamed that he should one day be called to the directorship of the Meteorological Office. The first course he gave as lecturer on natural science at Cambridge was on meteorological instruments, in 1897. Fortunately, however, for his subsequent career as a meteorologist, he was at the same time laying the secure foundations of a general knowledge of physics and mathematics—the necessary propædeutics of all serious work in meteorology. A glance at the list of his contributions to scientific literature during his residence at Cambridge reveals an extraordinarily wide range of interests; electrolysis, ventilation, acoustics, pyrometry, thermodynamic problems, were a few of the subjects that he attacked with especial zeal, and to which, in each case, he added something of his own. As early as 1885 he published, conjointly with Glazebrook (now director of the National Physical Laboratory), a textbook of practical physics, which has passed through several editions.

When in 1891 he was elected a fellow of the Royal Society he held a commanding position among physicists, and his genius as an educator was conceded to have placed the teaching of physics at Cambridge upon a more dignified footing than had ever before been granted to it—but he was hardly yet accounted a meteorologist. In 1897 he succeeded Stone, the Oxford astronomer, as a member of the Meteorological Council of the Royal Society—which was, in those days, the governing body of the Meteorological Office. Not until 1900, however, did he definitely embark upon a meteorological career. In that year R. H. Scott retired from the position of administrator of the Meteorological Office (as secretary of the council), and Shaw was called from Cambridge to succeed him.

From the moment that he took up his new work in what, in a recent tribute to a deceased colleague, he has called "the unpretentious room over a piano shop in Victoria Street which for more than forty years has been the chief center of meteorological work in this country," the Meteorological Office awoke to new life. Official meteorology is not generously treated by the British government. It is supported by an annual Parliamentary grant which, together with miscellaneous revenues from other sources, amounts to less than $100,000, i. e., about one-sixteenth as much as Congress appropriates annually for the United States Weather Bureau. How, with the meager means at his disposal, the director of the Meteorological Office is able to keep up even the routine of a great national weather service is a mystery to his cisatlantic *confréres*. This routine work includes among other things the preparation and publication of daily, weekmonthly and annual reports, containing the results of observations at a few large observatories and a great number of small stations. In response to the frequently expressed desire of the International Committee for the prompt publication of data, Dr. Shaw has gradually brought up the arrears of these reports, which now appear so punctually that they set the pace for all publications of similar character throughout the world. Formerly one had to wait three or four years for the *in extenso* returns of the English meteorological observatories; now one gets them in as many months.

The compilation of these returns, the daily weather forecasts, and the superintendence of the instrumental equipment, along with incidental clerical duties, might well be expected to absorb all the energies of the little staff of meteorologists and clerks, formerly housed in the cramped quarters "over a piano shop" for which Dr. Shaw's epithet "unpretentious" was somewhat unduly charitable—but, since last year, more happily installed in new and relatively spacious premises in South Kensington. Such, however, is far indeed from being the case. At brief intervals the office publishes memoirs on special topics, ranging over a wide field, and so pregnant with timely interest as to give outsiders the impression of being the fruit of ample leisure rather than of odd moments snatched from the "trivial round."

If it be asked what all this has to do with the subject of our sketch, the answer is that all the publications of the office bear, at least, the unmistakable marks of his directive genius, and not a few of them have come chiefly from his own pen. In an address before the British Association a few years ago he expressed his views as to the relation of routine to extra-routine duties at the office in the following words:

"There is a tendency among some of my meteorological friends to consider that a meteorological establishment can be regarded as alive, and even in good health, if it keeps up its regular output of observations in proper order and up to date. That is a view that I should like to see changed. To me, I confess, the speculation which may be dignified by the name of meteorological research is the part of the office work which makes the drudgery of routine tolerable. For my part I should like every worker in the office, no matter how humble his position may be, somehow or other to have the opportunity of realizing that he is taking part in the unraveling of the mysteries of the weather; and I do not think that any establishment, or section of an establishment, that depends upon science can be regarded as really alive unless it feels itself in active touch with that speculation which results in the advancement of knowledge."

Since his election to the presidency of the International Meteorological Committee, in 1907, Dr. Shaw has displayed, on a larger scale, the same genius for organizing and directing scientific work that distinguished him when, in his earlier years, he built up the department of physics at Cambridge, and that he later brought to bear upon the task of reorganizing and revivifying the Meteorological Office. Meteorology stood in need of just such a leader. He is not, as the typical Englishman is reputed to be, unduly wedded to the past. On the contrary, he is sometimes criticised for being in advance of his times. He has, for example, led the movement that aims to reform the units of measurement employed in meteorology, and stands ready to throw overboard the whole cumbersome system of inches and feet and Fahrenheit degrees; he has, in fact, already done so in the upper-air work of the office.

A few evidences only can be quoted in this brief sketch of the advanced position that he has come to occupy in the general campaign of meteorological research: There is urgent need of gathering in the scattered results of climatological observations made in countries that have no regular weather services. In recognition of this need Dr. Shaw has set the example by undertaking to publish all such data obtainable in the smaller British colonies, and heretofore almost wholly inaccessible to the scientific public.

(Continued on page 176.)

Integral Photography

A New Discovery by Professor Lippmann

By the French Correspondent of the Scientific American

PROF. LIPPMANN of Paris is working on a very remarkable new photographic method which he has termed "integral photography." The nature of this is best explained by reference to the accompanying diagram. It should be remarked in the first place that the process is designed to work without a camera. The sensitized plate is coated with a large number of very small globules of glass or other transparent material. In use each of these acts as a miniature eye, with a sensitive plate for its retina. The globules are very small, less than one-hundredth of an inch in diameter. In front each has a little blob which acts as the lens of the miniature eye. Suppose an object to be situated at *M M'*, as indicated in the diagram. Consider any globule. Rays from the points *M M'* will pass through the minute lens, and an image will be formed at the back of the globule upon the sensitized plate at *M M'*. Thus each globule will contain a minute picture of the objects placed in front of the plate. This picture is brought out by developing the plate and fixing it in the usual way. This of course yields a negative, which must be reversed by the use of a suitable reversing bath. The result is a transparency, in which all the minute pictures in the individual globules are combined into one image of the original object. To view it, a good light is placed behind the plate, so as to send light through all the globules. Suppose the eye viewing the transparency to be placed at *O*, the point which when the picture was taken, lay on a line joining one globule with the point *M* of the object. The process which now occurs will be the opposite of what happened when the picture was taken. In other words, the eye will receive from the globule a view of the image *m* of the point *M*. Other globules will send images of the point *M'*, etc., at the same time, so that the eye will see the different portions of the image coming from all the different globules. In this way a complete image of the object originally presented to the plate is seen. If the eye is placed at some other point *O'*, or if *O'* represents the position of the other eye, the object will also be seen, but the light received at the eye will come from somewhat different portions of the globules, and the appearance presented will differ accordingly from that seen at *O*. The difference is of precisely the same kind as that which distinguished the appearance of the same object when seen from two different points. In other words, when passing from *O* to *O'*, the observer will receive the same impression, in looking at the transparency, that he would if he were to move in this way while looking at the original object. For example, in one position a certain object might be hidden behind a tree, in the second position this object might become visible. Again, if *O* and *O'* should represent the positions of the two eyes, each will receive a slightly different impression, with the result that a stereoscopic effect is secured. This is explained by the fact that certain portions of the landscape appear in certain of the globules, but not in others. The image which the eye sees is made up of points coming from different globules, and as the eye moves, and different parts of each globule are viewed, the contribution which each sends to the eye is changed in accordance with the direction in which the eye is looking at the globule.

After working out this remarkable principle, Prof. Lippmann presented it before the French Academy of Sciences and other scientific societies, where it awakened great interest. The realization of the process presents considerable technical difficulties. Owing to their small size, it was out of the question to shape each one of the globules separately. Prof. Lippmann tried using minute glass beads, such as are found in commerce and used for covering ornamental surfaces, such as picture post cards. He found, however, that these were too irregular in shape and size. Another idea which suggested itself was to stamp out a transparent sheet of collodion and gelatine, giving the surface the requisite shape. But the dies required were found to be too difficult to make in the laboratory, so that Prof. Lippmann has been forced to abandon his attempts in this direction for the time being. The fact is that the working out of a process of this kind is a technical

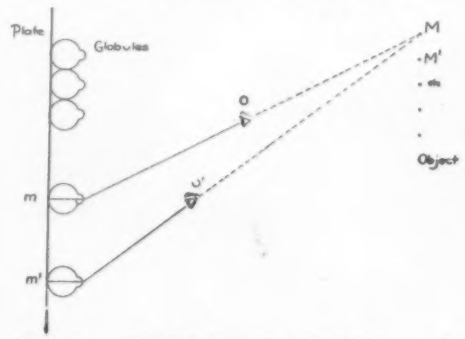


Diagram to illustrate the principle of Lippmann's integral photography.

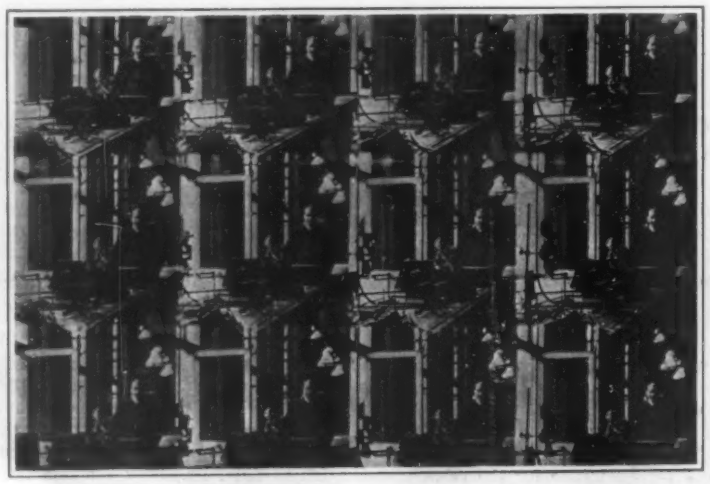
rather than a scientific problem. There is a good field here for inventors to exercise their ingenuity, for if a Lippmann photographic plate could be made it would be of great value, inasmuch as in order to take a photograph the plate is simply exposed to a landscape or other object, without any camera at all, and the picture obtained possesses the remarkable properties explained above.

In the meantime Prof. Lippmann has been making some interesting experiments with an apparatus which is intended to show some practical results of the principle expounded, and without use of such minute globules he has succeeded in producing some very striking effects. A number of ordinary lenses (even spectacle lenses may be used) are cut into square shape, so that they can be fitted together into a continuous surface. A number of such lenses are put in the front wall of a camera, as shown in our illustration. The more lenses are used, the better is the result obtained, but twelve is found to be a sufficient number. These lenses correspond to the globules spoken of above, each image being formed on a separate portion of the photographic plate at the back of the camera. Each lens makes a picture on the plate, the portions of the plate illuminated by the several lenses being kept separate by an arrangement of black cardboard cells or partitions. One of our views represents the front of the camera with a set of twelve lenses, while the rear view shows the cells in the plate-holder. This latter carries a large plate of such size as to receive all the twelve pictures, and is placed in the camera as usual. The plate-holder, however, is made with a slide in the back as well as in the front, for a purpose which will appear presently. After the picture is taken, the negative is developed as usual, and is reversed either by means of a reversing bath, or by copying it, so that a transparent positive is obtained. The twelve pictures are not quite alike, for each lens forms its image from a somewhat different point of view. The transparency is put back in the holder, both slides of which are now opened, while light is sent through from behind. The observer looks in through the lenses with both eyes, when he sees a single view in relief of the object photographed. On moving the head from side to side, or up and down, the same effect is observed as would be under similar circumtances when looking at the real object, that is to say, objects which cover one another when looked at from one point, are seen to separate when viewed from another. Even with this simple apparatus the effect is very pleasing.

Proposed Aeronautic Map

AT a recent meeting of the Academie des Sciences, M. Lallemand, chief of the French Government Survey Department, presented the project which the Aeronautic Commission intends to carry out establishing an aeronautic map. The proposed map is of 1:200,000 size, and is drawn up after a provisory model made by the Aero Club. Each plate of the aeronautic map will be a sheet taking in one degree in latitude and longitude and there will be twenty-four such sheets included in one sheet of the world's map. This latter sheet occupies 6 degrees longitude by 4 degrees latitude. The longitude will be counted from 0 degrees to 360 degrees toward the east starting from the meridian lying exactly opposite to Greenwich, and the latitudes, or rather the distances from the South Pole, will be numbered from 0 to 180 degrees toward the north. Each sheet will carry a number which designates it. On the other hand, on the ground or the roof of a building will be traced a large square, and the position of that particular locality on the map is shown by a large circle or disk. To the left will be placed a large number showing the units of the latitude and to the right the figure for the longitude, but using only the unit figures in each case, as an error of 10 degrees, or from 400 to 700 miles, could hardly be made by a pilot as to his position, so that such figures will be enough to guide him. Thus he finds what leaf of the map he is to use for this locality. In order to make a trial of the new plan, it was decided that three specimen sheets of the map should be made by the Aero Club, and these will be put in the hands of the army pilots during the next annual maneuvers.

Prof. Lippmann's camera, showing the front with its twelve lenses.



View in Prof. Lippmann's laboratory. A twelve-fold image formed by as many lenses.

The rear of the camera, showing the cells and plate-holder.

APPARATUS AND RESULTS OF THE NEW LIPPMANN METHOD OF PHOTOGRAPHY

Water in Motion

Some Examples of the Tremendous Energy of Waves and Floods

MEASUREMENTS of the size of waves have now been made systematically for many years, but they relate chiefly to the waves of the open sea, where the depth of the water is so great that the friction of the sea bottom exercises no modifying effect.

A few months ago the North German Lloyd liner "Brandenburg" came into New York harbor with her crow's nest, 50 feet above the water-line, stove in, and bearing many other marks of the damage wrought by a monster wave that broke over her bows about 1,000 miles east of Sandy Hook. The officers estimated the height of the wave at 65 feet. This height is exceptional, but not unprecedented; for it must be remembered that the breaking of a wave against an obstacle throws the water to a far greater height than the unbroken wave could attain.

Unbroken waves due to the wind may, in extreme cases, reach a height from trough to crest of 40 to 50 feet. Much higher waves occasionally occur as a result of earthquakes or seaquakes. "Solitary" waves of this character have sometimes been encountered in otherwise tranquil weather, taking vessels by surprise and not infrequently sending them to the bottom.

According to Vaughan Cornish, who has probably devoted more attention to this subject than any other contemporary man of science, the average height of the waves encountered in a severe storm at sea is 20 feet, but the ordinary maximum height of the waves in the same storm will attain 30 feet. In a storm of very exceptional violence the average height may reach 30 feet, and the maximum height 45 feet. This is regarded as about the limit of the height of waves due to wind only. Cornish finds that in the open sea the height of a wave in feet is about one-half the velocity of the wind in miles per hour. The following table, computed by W. H. Wheeler from a great number of observations, shows the relation of the wind to the dimensions and speed of ocean waves:

Wind.			Waves.			
Speed.*		Force, Pounds per Sq. Ft.	Height in Feet.	Length in Feet.	Speed.	
Feet per Second.	Statute Miles per Hour.				Feet per Second.	Nautical Miles per Hour.
2	1¼	0.02	0.66	17.4	2.32	1.4
6	4	0.08	1.98	52.2	6.96	4.2
13	9	0.36	4.29	113.1	15.08	9.0
20	14	1.	6.60	174.0	23.20	13.9
27	17	1.50	8.91	234.9	31.32	18.8
30	20	2.	9.90	261 0	34.80	20.8
35	24	3.	11.55	304.5	40.40	24.2
44	30	5.	14.55	382.8	51.00	30.6
50	40	8.	19.47	513.3.	68.44	41.0
95	67	23.	31.35	826.5	110.30	66.1
118	80	32.	The proportions of these waves are so various that averages cannot be given.			
147	100	50.				

So much for waves on the high seas. These waves, though they may race along at the speed of an express train, do not carry the surface water far with them; each particle of water describes a local circular orbit during the transit of the wave; so that what advances is rather the form than the substance.

The case is quite different when waves break upon a shore, where the shoaling water produces "waves of translation." These waves are relatively short and steep, and break when they enter water the depth of which is equal to, or a little exceeds, their height from trough to crest. They approach the shore in a direction nearly at right angles to the general shore line, whatever the direction of the wind. This is explained by the fact that, if the wave is at first directed at an acute angle to the shore, when it reaches shallow water the side of the wave nearest the shore is first retarded, so that the wave tends to swing around until it faces the shore.

In planning harbor construction and the protection of coasts it is customary to consider the amount of exposure to which the coast is subject; i. e., the extent of open sea in a straight line at right angles to the shore. This is called technically the "fetch." The relation of the fetch to the possible height of the waves was announced by Stevenson in 1852. According to his formula the height of waves in a gale, in feet, is one and one-half times the square root of the length of the fetch in nautical miles.

The force of a great wave breaking against a sea wall or other construction is so terrific as to tax the strength of the best-planned work of the engineer. A marine dynamometer for measuring the force of impact of such waves was devised by Stevenson over half a century ago, and modifications of this instrument have since been introduced by several investigators. According to Stevenson, the maximum force of an Atlantic wave is three tons per square foot. French engineers find that the force of the waves on the breakwater at Cherbourg may attain three and a half tons per square foot.

Some interesting examples of the height to which breaking waves may be thrown, and the work they may do in moving heavy objects, are given by Wheeler in his "Practical Manual of Tides and Waves."

Stevenson records a case in which water was thrown to a height of 106 feet at the Bell Rock Light. At the Alderney breakwater it is said that water has been thrown upward 200 feet. At Peterhead, where the "fetch" is 300 miles, waves of 30 feet in height and from 500 to 600 feet in length have been recorded, the water has struck the breakwater with such force as to be thrown upward 120 feet, and blocks of concrete weighing 40 tons have been displaced at levels of 17 to 36 feet below low water.

At Wick two stones, weighing eight and ten tons each, were thrown over the parapet of the breakwater, the top of which was 21 feet above high water; while blocks of concrete weighing respectively 1,350 and

* These particular intervals of wind speed were chosen as representing the successive steps of the "Beaufort scale," according to the equivalents formerly assumed for this scale. As the latter are now known to have been much too great, we have omitted the Beaufort numbers from Wheeler's table.

The aftermath of a river flood, showing gouging effects. (Kansas City, 1903.)

Effect of storm waves. Here they entered the second story of the house.

The breaking of a levee in a Mississippi flood; the rush of water through the crevasse.

Havoc wrought by storm waves in a Gulf hurricane.

SOME EXAMPLES OF THE TREMENDOUS ENERGY OF WAVES AND FLOODS

2,500 tons were displaced, though there is some doubt whether the latter movement was due entirely to wave action.

At the Bishop Rock lighthouse, which is exposed to the full force of the Atlantic waves, an iron column weighing over three tons was thrown up 20 feet and landed on top of a rock.

At the harbor works of Bilbon, in 1894, a solid block of the breakwater weighing 1,700 tons was overturned from its place and dropped into the water.

At Ymuiden breakwater a block of concrete weighing twenty tons, placed outside the harbor walls, was lifted by a wave to a height of 12 feet vertically and landed on top of the pier, which was 5 feet above high water.

The above cases illustrate the sheer force of the individual wave as an engine of destruction, but the imagination of mankind is more impressed by the widespread effects wrought by the great storm waves that sometimes inundate low-lying coasts. These waves are often miscalled "tidal waves," the only justification of the latter name being the fact that their effects are most pronounced when the wave propagated outward from a storm area happens to coincide with the occurrence of flood tide on the coast affected.

The precise mode of origin of the storm wave has been the subject of much discussion, and even now is not fully understood. Such waves attend every severe cyclonic storm at sea, and as they travel much faster than the storm (i. e., the storm as a whole, not the wind revolving about the storm center) they often occur on a coast when the weather is otherwise serene, and thus serve as a valuable prognostic of the storm's approach, in case the coast happens to lie in the storm track.

It is well known that the barometric pressure is much lower at the center than at the periphery of a storm—the difference sometimes amounting to two inches or more—and this difference of pressure must disturb the equilibrium of the water, causing it to become heaped up at the storm center. This bulging of the water would amount, theoretically, to about one foot for each inch of barometric depression. However, although this process doubtless contributes to the production of the wave, the violent winds at the vortex of the storm are probably a much more important factor.

The mechanism of storm waves was studied by a board appointed by the Chief of the United States Weather Bureau for this purpose in 1901; and the reader is referred to the report of the board, published in the *Monthly Weather Review* of October, 1901, for further information on the subject.

We are concerned here chiefly with the effects of storm waves (which the newspapers and the public call "tidal waves," as persistently, and with as much reason, as they call tornadoes "cyclones"). These are most severe when the wave moves toward a low-lying coastal region, having a converging shore-line; this convergence producing the same effect as seen in a tidal "bore."

The most disastrous storm waves have occurred along the coast of the Bay of Bengal, on the extensive flats lying about the mouths of the Hugli, the Megna, etc. The storm wave of October 7th, 1737, is said to have risen 40 feet in the Hugli, sweeping away 300,000 souls. In May, 1787, at Coringa, near the mouth of the Godavery, such a wave is said to have taken toll of 20,000 lives. The Calcutta cyclone of October 5th, 1864, caused the inundation of the flats on both sides of the Hugli estuary, with a loss of about 48,000 human lives, and the destruction of 100,000 head of cattle. The greatest disaster of recent times in this much-afflicted region was the Backergunge hurricane of the night of October 31st-November 1st, 1876, which cost the lives of over 100,000 persons. In this storm the water rose from 30 to 40 feet in less than half an hour.

The islands of the Pacific are also subject to visitations of this character on a huge scale, in connection with tropical hurricanes. The latest of these was the storm of March, 1910, which was especially remarkable for the vast area that it covered, its track extending some 2,500 miles, from Fiji to New Caledonia, Norfolk Island, and the North Island of New Zealand. Statistics of the loss of life and property in this storm are not yet available.

Our own seaboard has repeatedly suffered from the effects of storm waves. In the Galveston hurricane of September, 1900, a series of waves invaded the city; 6,000 lives were lost, and the destruction of property amounted to $30,000,000. The damage was due to wind as well as water, but chiefly to the latter.

It remains to say a word concerning quite another kind of wave, viz., that which moves down a river in flood, often causing widespread inundations of the adjoining shores.

The total volume of water discharged by a great river is so enormous that it is commonly expressed in units of a million cubic yards. The normal annual discharge of the Mississippi system is 785,190 of these units. The occurrence of a flood depends upon many factors, which fortunately rarely combine their maximum effects at a given moment. Thus the maximum *possible* discharge of the lower Mississippi is about 3,000,000 cubic feet per second, which is about one-third greater than has ever occurred, so far as known.

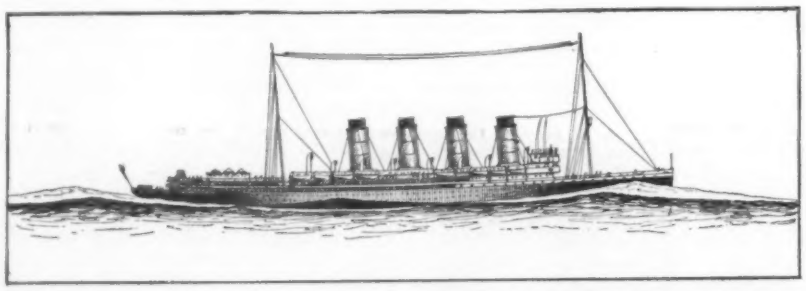
The most destructive river floods of which history furnishes any record are those that have occurred in China; especially those of the Hwang-Ho—"China's Sorrow." We hear of occasional changes in the course of the Mississippi, whereby a property-holder is presented with, or robbed of, a few acres of alluvial land over night, or a cut-off shifts a few square miles of land from one bank to the other; but what shall we say of a river that has bodily abandoned hundreds of miles of its channel no less than nine times, thus changing the position of its mouth to the extent of five degrees of latitude? The havoc wrought by these migrations of the Hwang-Ho—to say nothing of the floods that have not involved a general shifting of the channel—staggers imagination. It is most conveniently stated in terms of human lives swept away; and we are told that during the fifteen years beginning with 1851 (including the last great change in the course of the river) between forty and fifty million human beings fell a prey to the fury of the waters.

The floods of the Seine, of recent memory, as well as all other similar disasters of the western world, sink into insignificance in comparison with this record.

What of the means of ameliorating the regimen of our rivers—diminishing their liability to flood? Forestation used to be considered the panacea, but to-day our judgment is suspended on this question. The doctors disagree.

River engineering has worked wonders. If the destructive flood comes in spite of the engineers, then we can only look to the flood forecaster to give us timely warning—and stand from under.

River stage prediction has reached—above all in America—a degree of accuracy that nearly reconciles us to the floods in consideration of the pride we feel in this particular branch of scientific achievement. This, however, is subject matter for another story.



White wave line wind 67 miles per hour; height of wave 31.35 feet; length of wave 826.5 feet
Black wave line—wind 30 miles per hour; height of wave 14.55 feet; length of wave 382.8 feet.

No Two Finger Prints Alike

SINCE the time when the late Sir Francis Galton proposed the use of "finger-prints" as means for identifying criminals, soldiers, and people generally, there has been great hesitation on the part of many people to accept the absolute individuality of the markings on the finger tips as certain. To most of us it is very hard to conceive that there cannot be two fingers that are exactly alike. When the police try to fix the guilt for a crime by showing the identity of the finger-print of the accused with that left on a window or a weapon, for example, many people consider the evidence as far from conclusive. A recent murder case in New York city involved finger-prints as evidence of identity, and the attorneys of the defendant appealed the case on the ground that the evidence left room for "reasonable doubt."

A communication to the French Academy of Sciences by M. V. Balthazard is of interest in this connection. This student finds that if any finger-print be divided into a hundred squares, each square will contain some distinctive mark, rarely two marks and only in very exceptional cases three or none. These marks are either the branchings of the ridges that you can see on the tip of your finger, or terminations of ridges. Two finger-prints differ from each other either in the arrangement of the marks in the different squares, or in the character of the marks in a particular square. The total number of combinations of the two kinds of marks in the hundred squares is the one-hundredth power of 4 (4^{100}). This is a number that no one can possibly imagine; it is equal approximately to a number that would be represented by the figure 1 followed by sixty zeros. This means that there are possible just so many different kinds of prints, and that no particular combination will occur more frequently than others. The chances, therefore, of any particular combination of marks occurring, may be represented by a fraction with *one* as the numerator and a denominator represented by 1 followed by the sixty zeros—a very tiny fraction of a chance indeed.

Now in order to compare this very slim chance with human chances generally, we must consider the population of the whole world. At the present time this is estimated to be, in round numbers, 1,500,000,000. There are about three generations in a century, or say about five thousand million different human beings. As each of these has, on the average, not more than ten fingers, that makes a possibility of about 50,000 million different finger prints in a century. In order to have enough human beings to furnish the fingers necessary for realizing all the possible combinations of marks, we should need a number of years represented by the figure 2 followed by forty-eight zeros. The chances for finding two finger-prints exactly alike would be about once in that length of time.

This period is of course inconceivable, and from a practical human point of view it is as long as "eternity." This length of time is vastly greater than the total length of the period since there was any kind of life upon the earth at all; it is even much longer than the length of time that astronomers calculate as necessary for the complete freezing of the sun.

But if it would take that long, approximately, before two human finger-prints appeared that were exactly alike, one may still ask how near alike may two finger prints be. Or to put the question in its practical form: In how many points must two finger-prints agree to make sure of identity? Dr. Balthazard shows on purely mathematical grounds that when two finger prints agree in 17 of the 100 squares, it is practically certain that they were made by the same finger. His reasoning is as follows:

If we look for a single coincidence, we may find it on examining four fingers. To find two finger-prints that have two coincidences, we must examine at least sixteen fingers. To find three coincidences between two finger-prints, we must examine at least sixty-four prints, etc. These numbers, it will be noticed, represent the *powers* of 4 corresponding to the number of coincidences sought. Thus, $4^1 = 4$; $4^2 = 16$; $4^3 = 64$; $4^4 = 256$, etc. The probability or "chance" of any number of coincidences occurring is 1 divided by 4 raised to the power of the number of coincidences. In this way we must find the number of coincidences whose probability is as 1 divided by the total number of fingers on the earth at any one time. This number is slightly less than seventeen, for the seventeenth power of four (4^{17}) is 17,179,869,184. (The total population being taken at fifteen hundred millions, this number is multiplied by ten—the number of fingers for each person—giving us 15,000,000,000 fingers at any one time.)

In actual practice it may not be necessary to find as many as seventeen coincidences to make sure of identity. If the two finger-prints that are being compared are known to have been made by Europeans, or by Americans, or by inhabitants of a certain district, the number of coincidences necessary to establish identity is much fewer. Bertillon found two finger-prints made by different men, having as many as thirty coincidences. This would seem to be at variance with the law of probability; but on examination it appeared that the two men were twin brothers.

However, the mathematical demonstrations may not be quite convincing to many persons. The doctrine of probability may be acceptable enough, but it remains to be shown whether all the combinations that are theoretically possible do actually occur in equal numbers; that is, whether there is not a tendency for certain combinations to occur more frequently than others, and whether, therefore, certain coincidences are not more likely to occur than others. Still, the numbers involved are so enormous, that for all practical purposes we may feel quite assured that what is likely to happen only once in a long, long eternity is *not likely* to happen twice in a century.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Cosmic Speculation

To the Editor of the SCIENTIFIC AMERICAN:

To modify if not entirely to prevent dangerous thaws, intense heat-waves, extensive droughts, and seismic disturbances, should be the primary aim of mankind in the present century.

Solar rays, striking the earth at right angles, have the effect, in one region, of suddenly dissolving and releasing huge ice-jams; in another, of overheating and evaporating vast quantities of water. This mass, in its new form, accumulates heat and electricity. If the phenomenon were to recur indefinitely, it would probably result in the total disintegration of the terrestrial mass. However, there may be noted, as counteracting the influences described: (1) the revolving motion of the earth about the sun, (2) the attraction exerted upon it by the moon, and (3) the irregular formation of its crust.

Yet the proceeding does repeat itself for days and months. When the former is the case, the phenomenon brings in its trail widespread inundations and the insufferable heat that annually numbers its victims by the thousand—particularly in this very country. And in the latter instance, when the occurrence continues for a considerable length of time, an exhaustion is produced of the general humidity as well as of the aqueous deposits left by previous rains in the soil and subsoil. These deposits ordinarily feed the internal streams and lakes whose function is refrigeration.

In reducing these cooling influences, the draining off of inner bodies of water heightens the internal heat, and with it the extent of evaporation and electricity; until the moment arrives when equilibrium is upset between the inner and outer electrical states, giving birth to a wave that precipitates commotion and disturbance.

On occasion, the phenomenon takes on more serious proportions, because of greater intensity in the sun's heat or through special circumstances existing in the interior regions. These contributory causes facilitate the action of "the mighty fluid" and combine with it to hurl outward the very bowels of the earth, to make room for the processes of deformation and disintegration.

In view of the advanced state of the sciences and the increased means of action at the disposal of man, the phenomenon should allow of easy modification. The remedy is to be sought in two directions: (1) By loud reports in the upper strata of the atmosphere, we may attract currents of air bringing cold from the regions that are far distant from the scene of overheating. (2) The natural course of events can further be modified by collecting, simultaneously with the explosions on high, the electricity stored in the atmosphere and in the bosom of the earth.

Small acts determine large effects. Deprive a huge boulder of a little stone that contributes to its equilibrium, and the mighty mass will overturn. Let a man shout, a gun give forth its report or a tiger roar, at a given place and at a given moment: immediately there will be unchained a down-pour, a tempest lasting hours.

A decade or more must elapse before we can determine the precise spot and occasion for such action. For perhaps a pair of decades our plans must hold fire; until we can reach into the depths of the earth with a receiver. Yet both ends shall certainly be attained. In the meanwhile, advantage can be taken of the art of aviation and of craters and their data to study the laws of the atmosphere and general geological chemistry.

The task set before us is not one for the individual. Rather does it confront the nations. World conventions, competitive contests for generous prizes, observatories and laboratories already in existence and yet to be created, all to be united into one association better to see and better to labor—such is the path to be followed.

New York city. R. FEBRES CORDERO.

The Bridgeport Railroad Wreck

To the Editor of the SCIENTIFIC AMERICAN:

In your article entitled "An Imminent Railroad Danger" in the issue of July 22nd, you speak of the "perfection of the track and equipment of our leading railroads." I feel, however, that, as far as the Federal Express is concerned, the description "perfection of equipment" does not apply. Being interested in such matters, I have frequently noticed particularly the equipment of this train as it stood in the South Station, Boston. The train usually consists of a large Pacific type locomotive followed by a baggage car (sometimes a Pennsylvania steel car), a New Haven wooden vestibuled day-coach (not of the most modern type) and then several Pullman sleepers, some of which are, sometimes, of the all-steel type built for use on the Pennsylvania Railroad. According to your opinion repeatedly expressed in your paper, such a sandwiching of a weak wooden day-coach between a heavy locomotive and heavy Pullman sleepers is about the most dangerous arrangement that could be devised. The fact that nearly all the deaths occurred in the day-coach shows the validity of your contention, which, however, is not difficult to understand in the abstract.

As for the matter of human control, it seems that it ought to be possible and not seriously inconvenient to so arrange the controlling levers in the cab that it would be necessary for the engineer to exert some little pressure on them to keep the throttle open and the brakes off. Then, if, through his unconsciousness or sudden death, the pressure were released, the train would automatically be brought to a stop.

Braintree, Mass. AUBREY D. BEIDELMAN.

Possible Size of Battleships

To the Editor of the SCIENTIFIC AMERICAN:

Apropos of the limits of size of battleships, at least for the American navy, it would seem the Panama Canal sets very certain restrictions. The locks have a length of 1,000 feet, a width of 100, and a depth of 40.

Supposing the maximum draft of a battleship to be 30 feet, its length to breadth 6:1, and its beam the maximum 100 feet, we have a limit (using the coefficient of fineness 0.600) 30,000 tons. If we extend the length and breadth to 7:1, we have with the same draft of 30 feet 36,000 tons. Suppose the draft to be enlarged to 35 feet, for the first set of proportions we have again 36,000 tons, and the second set (7:1) 42,000 tons. It is hardly possible that the length of a battleship with regard to its beam will exceed 7:1 with due regard to stability as a gun platform. Coincidently, 35 feet in all probability will be the maximum possible draft, having taken into consideration the depth of our harbors, and the possibly increased draft of a disabled warship.

As it is, with the maximum dimensions of 100 feet beam, 700 feet length, and 35 feet draft, there is no dock in the United States as far as I know that will take such a ship. Hence it appears that these are the outer limits of dimensions for our battleships; for after having constructed the canal, it would be superlative madness to neutralize it by building ships which could not use it. By increasing the coefficient of fineness, a somewhat larger tonnage might be obtained. Hence it would seem that the utter limit in size of our battleships is roughly 40,000 to 45,000 tons. From 1907 to 1911 the tonnage has jumped from 20,000 to 30,000—50 per cent. At the same rate of increase, in 1915 the limit will have been reached, and the battle of displacement will have given place to the battle of calibers.

Pittsburg, Pa. WILLIAM BERGEN CHALFANT.

Photography of the Invisible Ray

To the Editor of the SCIENTIFIC AMERICAN:

I was much interested in an article appearing in the SCIENTIFIC AMERICAN under date of June 10th upon "Photography by Invisible Rays," with photo illustrations of the theory. If you will look in a "Science Record" of 1874, published by Munn & Co., under the heading of "Photometry of Colors," you will find a brief outlining of some crude experiments I made to determine so far as possible the relative focal length of the colors of the solar spectrum, concluding that the shorter the focal length of a color, the greater its vibratory rate. With this theory as a working hypothesis, and the idea that light travels 186,000 miles per second of time, I made an estimate of the vibratory rate of each color motion in its action upon the photographic plate, thus disclosing the descrepancies between high light vibrations and those which promoted indistinctness in the negative. By interposing a thin pale straw-colored glass between the lens and the object photographed, all colors of a high vibratory rate were reduced to greater harmony. In indoor photography, I recommended flooding the sitter with some suitable color. Still another way is to attach a pasteboard tube to the camera lens, and flood the inside with some selective color, through which the color vibrations have to pass. I have employed every shade and tint of colored glass I could get. I obtained some remarkable results with fluids for a screen. A glass receptacle made of thin white flint glass an eighth of an inch for the fluid; the receptacle wide enough and equally long to cover the lens. Transparent fluids of different chemical density give astonishingly varied results.

I was the lecturer for the National Photographic Association at the time I refer to, and I think the SCIENTIFIC AMERICAN had a reporter in attendance. At that time I made the statement that "if the principles of molecular radiation were true, the time was not far distant when we could be able to photograph the internal human anatomy." I also said that "disease as a mode of motion in some of its phases could be photographed, in consequence of its action upon the epidermis." This has been done, and is done.

The striking similarity between your reproduction of Prof. Wood's experiments and several out-door photos made by my experiments, elicited my attention; and although I have no copies of my work in that line at hand, I am still deeply interested in any discovery that extends the lines of scientific research. I do not know how recently Prof. Wood made these investigations, but I want you to know that an American practically covered this ground, and much more, thirty-five years ago. You may recall me as one of your contributors in an essay upon "The Fourth Dimension of Space."

Buffalo, N. Y. DR. W. M. LOCKWOOD.

Nitrogen and the Soil

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of your paper dated July 1st, there appears on page 9 an article entitled "An Important Contribution to the Nitrogen Problem." This article refers to a bulletin published by Lyon and Bizzell of Cornell University, and entitled: "A Heretofore Unnoted Benefit from the Growth of Legumes." I am writing now to correct an error, since the priority of this discovery belongs to the New Jersey Experiment Station. A preliminary statement of these experiments is made in the annual report of the Office of Experiment Stations, United States Department of Agriculture, for the year 1909, page 150. A copy of this report may be secured from the director of the office at Washington.

A fuller statement of these experiments was submitted to the *Journal of Agricultural Science*, published at Cambridge, England, in the summer of 1909. After much delay this paper was published in the fall of 1910. The paper in question is abstracted in the Experiment Station record for April, 1911, page 423. The inclosed copy of this paper will show you that the problem was solved in a very exact manner by a method devised at the New Jersey Experiment Station.

I should feel indebted to you for calling attention to this fact in the columns of your paper.

JACOB G. LIPMAN, Acting Director.

New Brunswick, N. J.

The Moving Picture and the Psychology of the Chauffeur

To the Editor of the SCIENTIFIC AMERICAN:

I like your comment on the article in your paper, "Psychological Apparatus for Testing Chauffeurs," and would like to suggest that the complicated signaling system could be done away with by substituting a moving-picture machine. It ought to be possible to make suitable films for the purpose, with means for throwing the recording apparatus in motion, at the instant the person to be tested sees the picture on the screen.

Jewell, Ohio. H. G. PANNING.

Testing Chauffeurs with the Moving Picture Machine

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in reading Automobile Novelties. It doesn't seem to me that the signals for danger and different degrees of danger is a very fair test to the chauffeur, as he would have to be very familiar with the different signals before he could control his machine as well and as quick as he could under the conditions the signals represent or indicate. Now the moving-picture machine is perfected to such an extent, that the actual reproduction of danger can be produced in a most realistic manner; and it seems to me that by this means the test would be a far fairer one, as the chauffeur would have only his machine to think of, and in some emergencies this is a great plenty. It also seems that to put a real machine instead of the dummy would be an improvement, as it is well known that all men familiar with moving machinery of all kinds have a sense of feel that is highly developed, and would tend to put the chauffeur more at ease, as it would be more like the real thing.

Orange, Texas. F. T. RITTER.

The Knight Valveless Engine

By F. G. Sterling

IN THE usual automobile poppet valve the poppet or mushroom valves are lifted from their seats by cams and reseated by springs. In a four-cycle motor, the valves in each cylinder are opened and closed once in two revolutions of the crank shaft. This intermittent movement of the valve must be produced by a cam and a spring mechanism. The valve is not closed until it is in actual contact with its seat. Hence the valve must be free to seat itself under the action of the spring. Noise is produced when the cam strikes the valve to lift it, and also when the spring strikes the seat and starts to close the valve. This noise in itself indicates a tendency to wear. In the usual construction there is no way to provide for wear. Furthermore, neither cam nor spring is suitable for high speed work. While the poppet valves work well at low speeds, they are unreliable at high engine speeds, and the "timing," or opening and closing of the valves, is uncertain. This is the gravest objection to the poppet valve. By a radical change in design, Charles Y. Knight of Chicago has produced a design of valve for the four-cycle internal combustion motor, a design in which all the inherent disadvantages of the poppet valve are eliminated.

For some time prior to 1908, Mr. Knight manufactured and marketed in small quantities an automobile called the "Silent Knight." The claim for silence lay in the motor. Although successful enough, the car, owing perhaps to lack of detailed refinement and the use of the new motor, did not appeal to the automobile trade. Knight, whose chief interest was in the motor itself, thereupon took his invention to England, and succeeded in interesting the English Daimler Company in it. After many tests and further development and refinement the English firm adopted it.

Almost immediately the engine became the subject of much discussion and investigation by British automobile and technical societies, culminating in an exhaustive test by the Royal Automobile Club. As a part of this test a 38 horse-power motor (4⅞ inch bore and 5½ inch stroke) was run continuously for 132 hours under a load of 54 horse-power. The motor was then placed in a chassis and driven for 2,000 miles on the famous Brooklands track. Next it was returned to the testing rack and run for five hours more and developed 57 horse-power. Under the conditions of this test the load on the testing rack was never to be less than 1.3 times the calculated horse-power of the motor. The road test was to be made at a speed of not less than 40 miles per hour and the final return of the engine to its bench test was to determine its final condition.

These extraordinary conditions of the test were insisted upon by the Daimler Company, and the final bench test was especially desired by them. The reason is apparent when it is noted that the horse-power developed was in excess of the power developed at the start of the test, both tests being at the same engine speed—1,200 revolutions per minute.

Evidently the Daimler Company reasoned that while it might be possible for a poppet valve engine to meet the first and second stages of the test it was obviously impossible for such a motor to meet the final stage, i. e., to develop more power, to be in better condition after continued running. After the motor had successfully withstood the test, the Daimler Company was awarded the Dewar trophy and the motor received the unqualified official indorsement of the Royal Automobile Club's technical committee.

Extensive tests and experiments have been made on the motor in this country, with the result that three American firms have secured licenses. In a few years the new motor will be as well known here as it is abroad.

The motor is not really valveless, nor is it in any way akin to the two-cycle motor. Knight's invention is a mechanical or structural improvement in the design of the valve mechanism.

The valve mechanism consists of two concentric sleeves sliding up and down between the piston and cylinder walls. Certain slots in these valves register with one another at proper intervals, producing large and direct openings into the combustion chamber from the exhaust and inlet ports in the cylinder. The sleeves are operated by small connecting rods from a small crank shaft or eccentric shaft running at one-half the speed of the main shaft.

Fig. 1 shows the general arrangement of the parts and their nomenclature. The detail operations of the valves can best be seen by a glance at the seven diagrams comprising Fig. 2. In the diagrams the relative positions of the inner and outer sleeves at various points in the cycle of the motor are indicated. The method of reciprocating the sleeves by connecting rods from the eccentric shaft is shown. The eccentric shaft is positively driven, by a silent chain, from the main crank shaft and rotates at one-half the speed of the motor. The eccentric operating the inner sleeve is given a certain advance or "lead" over that of the outer sleeve. This lead, together with the rotation of the eccentric shaft at half the crank shaft speed, produces the cycle of operations.

In the first diagram the piston is just past its top center, and is starting down on its inlet stroke. The inner sleeve is at the bottom of its travel and moving slowly upward, the outer sleeve is about midway in its travel and is moving downward rapidly. The opening from the carburetor through the inlet port into the cylinder is a rapidly increasing space between the upper edge of the slot in the inner sleeve and the lower edge of the slot in the outer sleeve. By the time the piston is a little more than half way down on the suction stroke the inlet passage is wide open as shown in the second diagram of Fig. 2. The outer sleeve is now at the bottom of its stroke and moving very slowly, the inner sleeve is gaining in speed moving upward, and the inlet is closed by the lower edge of the inner sleeve slot in passing the upper edge of the outer sleeve slot, as shown in the third diagram of Fig. 2. The inner sleeve continues to move up with the piston on its compression stroke, the rings in the head and piston tightly sealing the compression space, until the explosion occurs. The sleeves and piston are then in position shown in the fourth diagram. About two-thirds of the way down on the explosion

(Continued on page 176.)

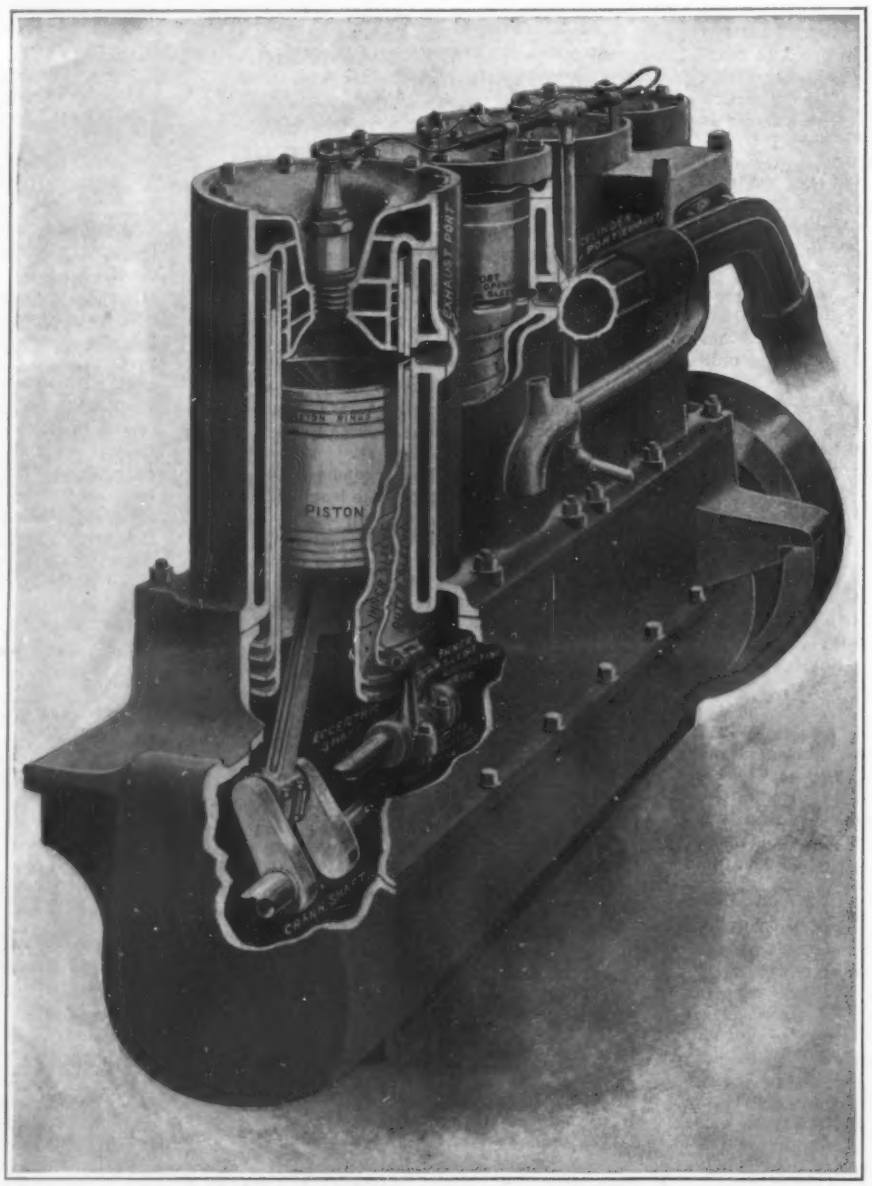


Fig. 1.—Sectional view of a Knight sleeve-valve motor, showing arrangement of the parts.

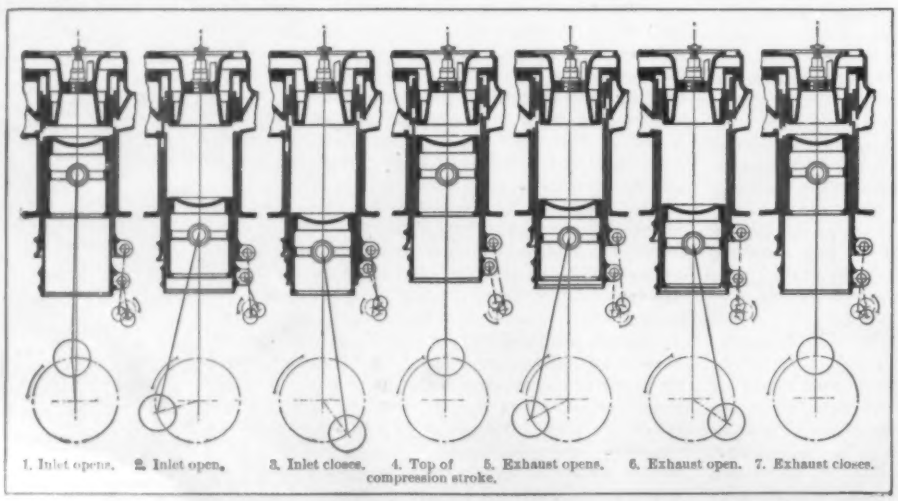


Fig. 2.—Relative positions of sleeves and piston in the operation of the Knight engine.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

What Railroad Accidents Cost

ALTHOUGH the railroad companies take every possible precaution to avoid wrecks, the newspapers constantly report more or less serious accidents. Few of us realize what a money loss almost every one of these entails. Some figures on the wreck of the Brewster Express on the Harlem division of the New York Central and Hudson River Railroad, published in a recent number of the *Railway Employees' Magazine and Journal*, prove that any expense for prevention is economy.

That wreck occurred near Woodlawn, February 16th, 1907. Without including damages to equipment, loss owing to delayed traffic, and other things, the damage claims and other expenses paid and in process of settlement cost the road $1,214,000. Of this, $659,000 was paid in claims, and the balance was for lawyers' fees, fees to agents who settled claims out of court, physicians, investigators, and experts, and for trial suits.

The largest amount paid for a single death was $75,000; the smallest $5,000. The average was $13,324. Eighteen of the twenty-two victims were women, eleven of them unmarried, which reduced materially the damages the company had to pay, though several of the single women were bread-winners.

Among the injured, the highest damages awarded were $32,500 to a young woman whose left leg was amputated. This verdict has been appealed by the company. Settlements for injuries have ranged from $1,000 upward.

The History of the Present Cholera Epidemic

THE following data, taken from the French publication *Larousse Mensuel*, regarding the cholera epidemic, of which we have recently felt some of the distant manifestations, may be of seasonable interest: The epidemic took its origin in India in 1902, and was carried to Hebjaz by the Hindoo pilgrims on their way to the rituals at Mecca. The disease was thus carried to Egypt, and in 1903 to Damascus, in 1904 to Bagdad, whence it crossed Persia and the Caspian Sea, reaching Baku and the mouth of the Volga. The cholera then spread in the Caucasus (three thousand cases in Russia), and in 1905 appeared in Poland (six hundred cases), whence it entered eastern Prussia and appeared in a number of places in Germany (three hundred cases). In 1906 little was heard of the epidemic, but in 1907 it carried off thirteen thousand victims, starting from southern Russia and ascending up to St. Petersburg in 1908 (thirty thousand cases). The plague continued its ravages in the domain of the Czar, and put forth a finger as far as Constantinople. In 1909 a number of foci of infection appeared in Russia (twenty-two thousand cases) and the disease made its appearance in several towns of Holland (sixty cases, mainly at Rotterdam) and of Belgium (nine cases), whither it was carried by ships. Forty cases were also recorded in eastern Prussia. Every winter the epidemic appears to die out, then it gradually resumes activity. In 1910 there were 281,259 cases (131,433 deaths) in Russia, especially in the southern provinces.

This great outburst resulted in a number of isolated cases in Germany and Austria, and in numerous cases observed since the month of August in southern Italy. The disease was carried there by a number of Russian emigrants who left ship at Brindisi. In this way 137 localities were infected. The balance sheet for the epidemic shows 11,700 cases, with 768 deaths. In Turkey also the disease made great ravages, of which, however, no statistical records are available.

Mode of Propagation.—Inasmuch as the period of incubation of the disease lasts only six days, any healthy individual who has been out of contact with any infected person for a period exceeding six days, used to be considered innocuous, and incapable of carrying contagion. It has, however, been observed that a person may very well carry microbes in his body, and disseminate the same without being himself affected. Hence arises the necessity of examining the dejecta not only of diseased but of healthy persons, as far as they may have been exposed to contagion. In Holland the rigorous application of this principle has reduced the number of fatal cases to four. While cholera may be generally contracted by contaminated drinking water, it may also be acquired through the ingestion of fruit and vegetables grown near the surface of the soil and watered with contaminated water. We may carry on our shoes and garments from the street into the houses portions of mud containing microbes, and upon brushing off such stains we distribute through the air dust and microbes which may fall upon food materials and thus enter the body.

Preventive Measures.—Of these the first and the chief is naturally the strict supervision of immigrants, sailors, and similar persons. That these are the carriers of the disease, and not the river water itself, is shown beyond question by the fact that the epidemic proceeds up the streams, against the current. The second precaution consists in careful attention to the proper disposal of waste matter and disinfection of the same, so far as persons afflicted with the disease are concerned, and the exclusion of flies. The food and drink and medicine for the sick person should be kept carefully covered. Water and milk should be boiled before drinking, and in fact only cooked products should be eaten, which moreover should be carefully protected from access of flies. Vegetables and raw fruit should be allowed to stand for half an hour in a three per cent solution of tartaric acid, and then washed with boiled water. Care should be taken not to partake of any foods (melon, unripe fruit) which irritate the intestines, so that the body may not be predisposed to offer a breeding ground for microbes.

The Motor Truck in the Country

THE *Engineering News* recently expressed the opinion that one use for the motor truck to which it would be difficult to place a limit is in direct haulage over considerable distances to save an intermediate railway journey. Direct deliveries may be made by automobile from a city wholesaler to his customers in towns twenty or thirty, or even forty, miles away at less cost, perhaps, than would be involved in the hauling to the railway station and hauling from station to receiver at the other end of the route, when the various rehandlings that are made necessary by the railway shipment are taken into account. The saving in cost of packing alone, where this method of delivery is used, may often make its adoption worth while.

"There are large possibilities also in the use of motor-propelled vehicles in industrial plants, shops and warehouses in place of the industrial railway or the overhead carrier, both of which systems are in extensive use," continues the *Engineering News*. "With present-day shop floors of concrete or wood-block paving, motor trucks can be run over them with little more friction than over the rails of shop tracks. A great advantage over the rail system is that the trucks can be run anywhere. There is no stoppage for turntables or switches, or because of cars blocking the line ahead as happens so often with industrial railways. In such a system, where current for charging is available at low cost and where the loads to be hauled are light, storage battery trucks appear to have great promise. The extent of this one field alone is so great that it will tax the ability and enterprise of many engineers and many manufacturers to adequately cover it."

Varieties of Whales

FEW of us realize that the blue or sulphur bottom whale found in all our oceans is not only the largest animal which lives to-day, but is also, so far as is known, the largest animal which has ever existed on the earth or in its waters. A writer in the *National Geographic Magazine* states that specimens have been measured which reached the length of 87 feet, and in all probability weighed as much as 75 tons. Although the mouth is enormous, large enough, in fact, to permit ten or twelve men to stand upright in it, the throat measures only about 9 inches in diameter.

"The finback, closely related to the blue whale, has been called the 'greyhound of the sea,' for its long, slender body is built on the lines of a racing yacht, and the animal can equal the speed of the fastest steamship. The back is dark gray, shading into beautiful light gray on the sides and pure white below. A noticeable characteristic about this whale is the symmetry of the throat coloring; the left side is dark slate and the right pure white like the under parts. The baleen also, on the right side, for a distance of about 2½ feet, is white, in sharp distinction from the remaining dark places.

"The humpback is the most interesting of all our large whales, partly because of the fact that its habits are more easily studied than are those of the other members of the family. Its maximum size is under 55 feet, but its body is thick and heavy, with enormous side fins, or flippers. These great paddles are one-quarter the length of the entire body, and a single one from a whale 49 feet long weighed on the station scales 956 pounds. The throat, breast, flukes and flippers of the humpback are almost invariably covered with masses of barnacles, or rather barnacles on barnacles, for the hard, shell-like Coronula are themselves the hosts of the soft pendant goose barnacles."

In Japan, the writer of the *National Geographic Magazine's* article studied the Sei whale of the Norwegians, which is the "Iwashi kujira" (sardine whale) of the Japanese. It is not a large animal, seldom exceeding 54 feet, and is formed on slender, graceful lines, much like the finback. Its coloration also resembles in a general way the latter species, but it can readily be distinguished by its high, falcate dorsal fin. The Sei whale has a habit of swimming just below the surface, sometimes with the dorsal fin exposed, and when feeding will travel for a considerable distance in this manner. It is a difficult whale to shoot, because the back is arched but slightly when the animal dives, and only a comparatively small part of its body is shown above the water at one time.

It is stated that the distance traversed by whales when beneath the surface of the water depends entirely upon circumstances. The longest period of submergence for finbacks, actually timed by watch, was twenty-three minutes, but there is little doubt but that most large whales can remain under water a considerably longer time.

Most extraordinary of all whales is the square-nosed sperm whale. Instead of having plates of baleen, this whale carries a row of 20 to 25 heavy teeth on each side of the lower jaw. These fit into sockets in the roof of the mouth, and assist in holding the giant squid and cuttle-fish on which the enormous animal feeds. Since the squid seldom gets far out of the warm currents, the sperm does not go into the cold water, but cruises about in the tropics and in the Gulf of Japan streams.

In the upper portion of the head the whale has an immense oil tank in which the valuable "spermaceti" is found in a liquid condition, and from which it may be dipped out with a bucket when an incision has been made. From a sperm whale 60 feet in length which was sent to the American Museum of Natural History from Japan 20 barrels of spermaceti were taken out of the "case" and the surrounding fat. This oil congeals as soon as it is cooled by the air, but the natural heat of the body keeps it in a liquid condition until the case is opened.

The sperm whale is the animal which yields ambergris, the valuable substance used so extensively in the manufacture of our best perfumes. Ambergris is only found in "sick" whales; that is, its presence is not normal, but is caused by a pathological condition of the intestines. It has been found floating upon the water, and is also taken from the intestines themselves after the whale has died or has been killed. It is used as a vehicle for perfumes, and not as an odor itself.

Abolishing the Postage Stamp.

IN our day the mail traffic of large business concerns has swollen to gigantic proportions, and even the simple labor of affixing stamps requires a special clerical staff. "No wonder, therefore," says the *Umschau*, "if the problem has been considered how the stamp could be abolished altogether without prejudice to the interests of the post office. Proposals of this character have not been wanting, as for instance in Bavaria, since February 1st, 1910, large consignments are simply stamped with a postmark at the post office, the operation being carried out by machinery. In this way the post office has saved the expense for paper and the printing costs for ten million stamps, while the business world has economized time and money, for affixing stamps to one thousand letters requires about an hour and a half of time.

"This method of treatment, while fairly satisfactory, is still primitive. We can easily imagine a much better system worked out somewhat along the lines of a gas or water meter, the letter being simply placed in a machine, and stamped with a postmark which serves at the same time as receipt for the postage and as record of the date, etc. The machine would be inspected periodically by the post office in just the same way as the consumer's gas or water meter is inspected, and his bill would be paid as usual."

Lessons of the 1911 International Cup Race

Comparative Features of the Types

By Grover Cleveland Loening, B.Sc., A.M., C.E., Author of "Monoplanes and Biplanes"

THE third race for the "Grand Prix" of aeroplaning—the cup and prize created by James Gordon Bennett—was held at Eastchurch, Isle of Sheppey, on the 1st of July.

The first race—that won by Curtiss in 1909—was over a distance of 20 kilometers. The following year the race, held at Belmont Park, for a distance of 100 kilometers, was won by Grahame-White. The distance this year was increased to 150 kilometers.

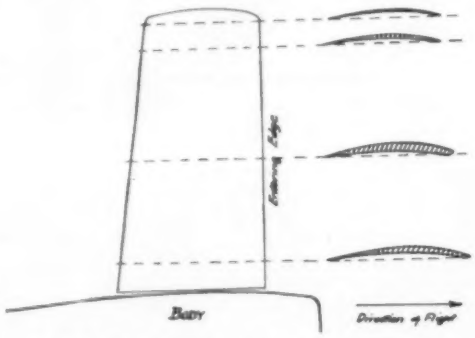
Curtiss' victory in 1909 was a splendid one, and well earned; the race of 1910 can but be described as a "fluke." Although the steady flying of Grahame-White won him much sincere praise, the unfortunate accident to Leblanc robbed him of the prize in the moment of victory.

This year's race, however, far surpasses previous contests, in the brilliancy of the flying and the highly instructive and satisfactory results given by it. The best talent of three of the greatest manufacturing concerns—the Blériot, the Wright, and the Nieuport—was set to the task of producing not only the speediest creation but one that would outwit its rivals in maneuvering and reliability. The monoplane proved itself the most adaptable type for speeding and the biplane the most easily controlled, the perfection of "banking," landing, and steady flying exhibited by the diminutive Wright, attracting much favorable comment.

The order of finishing and the official elapsed time of the contestants follow: Weymann (U. S. A.), 1 hour 11 minutes 36 1/5 seconds; Leblanc (France), 1 hour 13 minutes 40 1/5 seconds; Nieuport (France), 1 hour 14 minutes 37 3/5 seconds; Ogilvie (England), 1 hour 49 minutes 10 2/5 seconds. Chevalier and Hamel, the former on a Nieuport monoplane and the latter on a Blériot monoplane, started in the race but did not finish.

Weymann flew a Nieuport monoplane, and made an average speed of just 78.1 miles an hour. Leblanc on his Blériot racer averaged 75.91 miles an hour. Nieuport on a monoplane of his own make attained an average of 74.94, while Ogilvie made 51.2 miles an hour, including time for a stop. The latter's speed of flying not considering the stop was 54 miles an hour.

Nieuport's speed was rather surprising in view of the record he made at Mourmelon on June 16th with the same 70 horse-power monoplane—100 kilometers at a rate of 80.24 miles an hour. Difference in atmospheric conditions might account for this.



Sections of the plane of the Nieuport monoplane.

Section of Plane - WRIGHT

Section of Plane - BLERIOT

Details of Planes.

The astonishingly small difference in speeds between the 30 horse-power Nieuport of Chevalier, the 70 horse-power Nieuport flown by its designer, and the 100 horse-power Nieuport of the victorious Weymann is a very noticeable fact and one deserving of the closest study.

The victory was primarily one for the Gnome motor and the French aeroplane industry in general, giving only a small insight into the enormous leadership France holds over the rest of the world in the development of the aeroplane. By no stretch of the imagination can the victory be said to be one for America except on what might be classed a technicality. Weymann not only flew a French machine equipped with a French motor but received his flying instruction in France under the tutelage of French experts.

Those who are pluming themselves on the great victory for America have therefore cause to hesitate.

May the contest of 1912 exhibit a more pronounced example of Yankee industry.

This race is the first from which concrete and valuable conclusions can be drawn; and its results point to many advantageous features that should be introduced into the next Gordon Bennett race to make it a means of stimulating greater perfection and of representing the highest achievements in aeronautical engineering.

Before pointing out important deductions obtained from a study of the machines and their performances, a brief description of each is given, accompanied by plans and elevations drawn to the same scale, thus enabling a graphic comparison to be made.

THE NIEUPORT MONOPLANE.

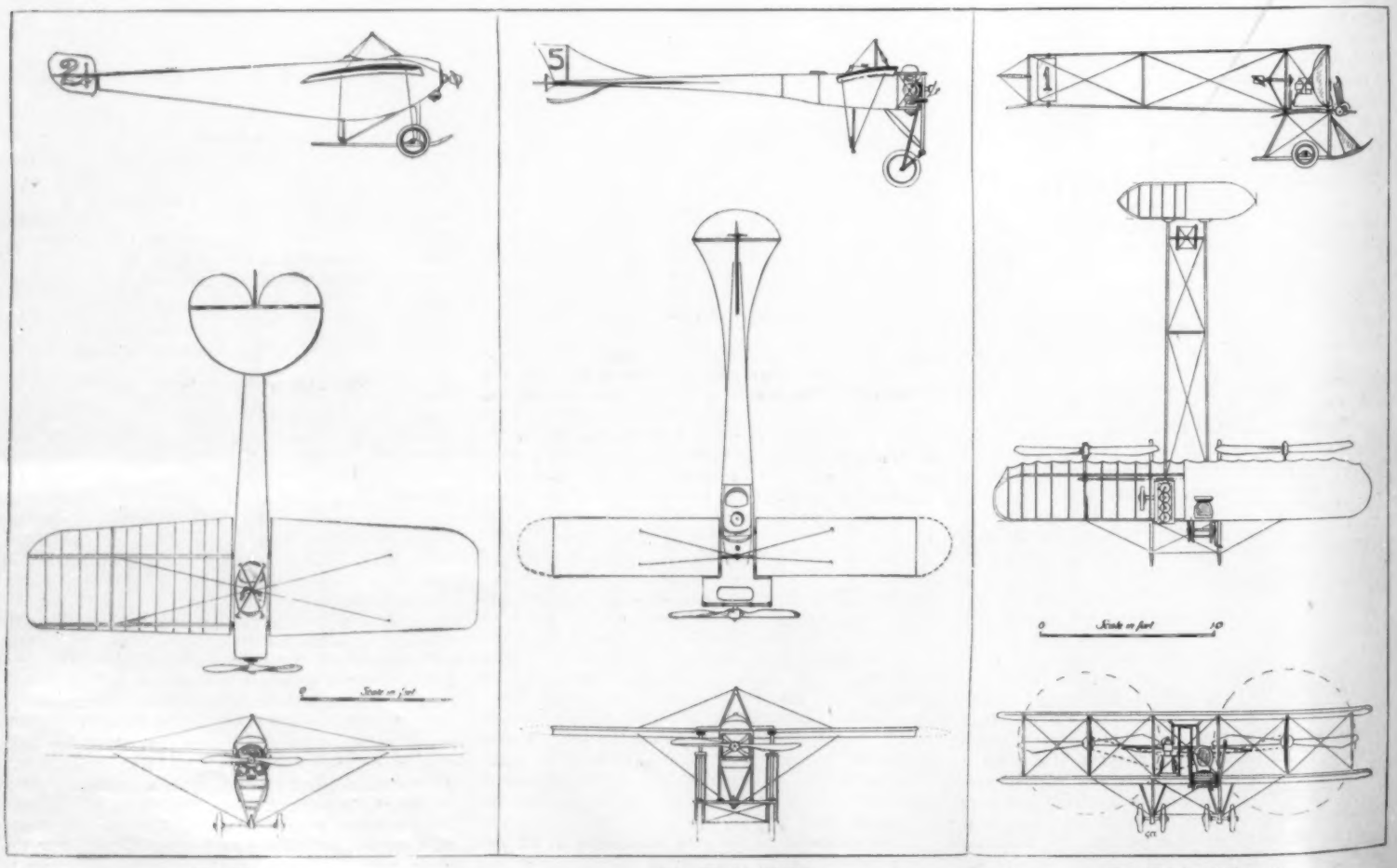
The winning machine is a distinct type, bearing little if any resemblance to the almost standard types, the Blériot or Antoinette.

The most important features in its design are the profile of the wings, the great reduction of head resistance, and the exquisite form and proportioning of the various parts.

Weymann's Nieuport was equipped with a 14-cylinder, Gnome engine rated at 100 H.P. This drove at almost 1,500 R.P.M., a two-bladed Regy propeller, 7 feet in diameter.

This machine, due to its high power, appeared to the spectators to fairly leap into the air, and dart about with arrow-like swiftness and precision.

(Continued on page 176.)



The Nieuport. The Bleriot XXIII. The Wright "Baby."

LESSONS OF THE 1911 INTERNATIONAL CUP RACE

The Satellites of Uranus

Moons That Have a Retrograde Motion

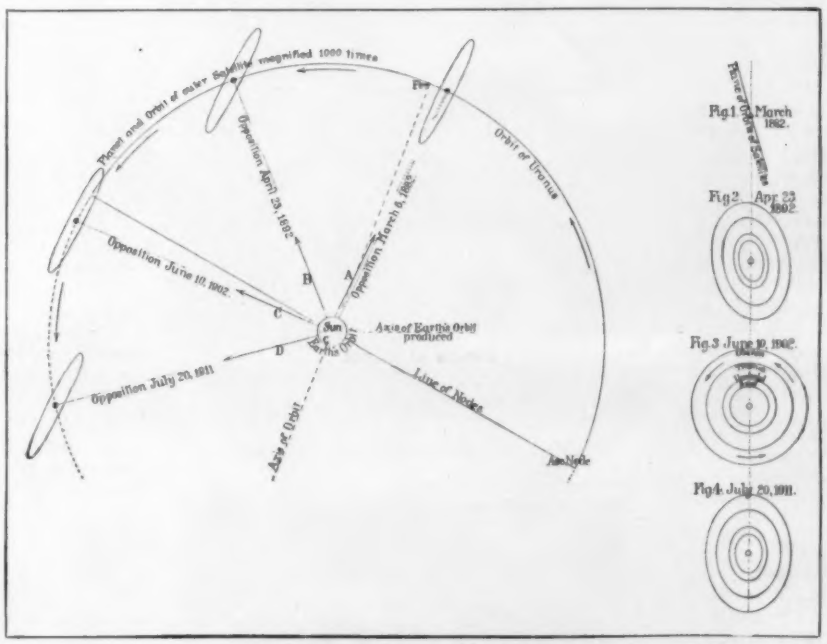
By Professor Frederic R. Honey, Trinity College

IN THE revolutions of the planets around the sun, and of the satellites around their primaries, there exists an apparent law of conformity to that general direction which is followed by our sun in its rotation on its axis. But the fact that this conformity, though followed by a large portion of our discovered system, is not invariable, is emphasized by its contradiction in the retrograde motions of the ninth satellite of Saturn and of all the satellites of Uranus and Neptune. These apparent contradictions in planetary revolution have naturally given rise to much inquiry and speculation regarding the evolution of the solar system.

The four known satellites of Uranus, which revolve in a plane which is nearly perpendicular to that of the ecliptic, appear at their vast distance from us to have diameters varying between 500 and 1,000 miles. The illustrations given in this article are for the purpose of emphasizing an example of departure from the general law of motion. The moons of Uranus, in contrast to their primary, revolve in a retrograde or backward direction—their orbital plane being just past the critical position of perpendicularity. Notwithstanding the great distance of Uranus from the sun, which is more than nineteen times the earth's distance, the planet's diameter of 32,000 miles renders it visible as a star of the sixth magnitude which is of a light sea green color. On account of the tilting of the earth's axis Uranus does not rise much above the horizon, and is seen to best advantage in northern latitudes during the summer months before and after opposition, which occurred this year on July 20th. The period of revolution is 84 years; and as a consequence the planet comes to opposition between four and five days later each year—its synodic period (average interval between consecutive oppositions) being 369 2/3 days. The plane of the orbit very nearly coincides with the ecliptic, forming an angle of only ¾ degree with it. This is the smallest angle of inclination of the orbits of any of the major or terrestrial planets; while the linear eccentricity, or distance from the center of the orbit to the sun (82.5 million miles) is greater than that of any of the orbits. This point is shown in the plot at *C* within the earth's orbit, and is about seven-eighths of the distance from the sun to the earth. The angle of inclination of the plane of the satellites' orbits, which was measured in March, 1882, is less than 98 degrees. The planet came to opposition on March 6th when approaching perihelion; but the plane of the orbits passed through the earth, and was seen edgewise, looking in the direction of the arrow *A*, about three weeks later, when the satellites appeared to move back and forth in a straight line (see Fig. 1). The next edge view, when the plane of the orbits will again pass through the earth, will be obtained in 1924, that is after an interval of 42 years. Fig. 2 shows the orbits seen in the direction of the arrow *B* at the date of opposition April 23rd, 1892.

During the years 1901, 1902 and 1903, the differences between the lengths of the axes of the ellipses representing the orbits on a plane perpendicular to the line of vision were so small that they were practically circular, showing the nearly perpendicular position of the orbital plane. Fig. 3 shows the orbits of the satellites *Ariel*, *Umbriel*, *Titania*, and *Oberon* as seen looking in the direction of the arrow *C* at the date of opposition June 10th, 1902. Since this date the minor axes of the ellipses have gradually contracted, and their positions looking in the direction of the arrow *D* on July 20th of this year are shown in Fig. 4. In each of these figures the position of the ellipses is shown relative to the meridian. These satellites revolve around Uranus (which is drawn to the same scale as the orbits) in the direction of the arrows. The distances from the planet and the periods or time of revolution are given in the table. In the plot of the orbit of Uranus the planet and the orbit of the outer satellite *Oberon* are magnified 1,000 times in order to show their relative dimensions, and the proportion between the axes of the ellipse which is the projection of the orbit on the plane of the ecliptic.

	Distance in Miles.	Period in Days.
Ariel	120,000	2.52
Umbriel	167,000	4.14
Titania	273,000	8.71
Oberon	365,000	13.46


Planet and Orbit of outer Satellite magnified 1000 times
Opposition April 23, 1892
Opposition March 6, 1882
Orbit of Uranus
Opposition June 10, 1902
Opposition July 20, 1911
Sun
Axis of Earth's Orbit produced
Line of Nodes
Axis of Orbit
Fig 1 March 1882
Fig 2 Apr 23 1892
Fig 3 June 10, 1902
Fig 4 July 20, 1911

THE SATELLITES OF URANUS

Treatment of Obesity

OBESITY is a disease of the general nutrition, characterized by a general hypertrophy of the adipose tissue, and an accumulation of fat in the organism. "A rough rule," says *Cosmos*, "is that an adult's weight, expressed in kilograms, should be represented by the two last decimals of the figure which expresses his height in meters. In a pretty severe case of obesity a person may weigh about 265 to 330 pounds; Barnum and Bailey exhibited an individual weighing 660 pounds. Heredity plays an important part in determining the occurrence of this morbid condition. This has been observed both in men and in animals. It is not every one who can accumulate body weight. At the same time, given a certain predisposition, there are certain conditions which favor obesity, and certain modes of living and treatments which may reduce it or even cause it to disappear entirely.

"Overfeeding, lack of exercise, in brief, an excess of the receipts over expenditures, favor obesity. Nevertheless, there are stout people who eat very little, and there are hearty eaters who remain thin. There must be some other element which enters into consideration. The thyroid and certain other glands regulate all oxidation processes. The secretions of these glands intensify the oxidation, their degeneration tends to diminish oxidation. The true cause of obesity is still a matter of considerable mystery. Generally speaking, a special diet and mode of living is unquestionably the right remedy, and has frequently proved effective.

Some medical authors have recommended a veritable hunger cure; others impose a meat diet. This last method is positively dangerous for arthritic patients, and may moreover be quite useless, since it is possible to fatten on a pure meat diet. Other authorities have recommended the use of foods of low alimentary value, taken in considerable quantity, such as fruit, green vegetables, but no meat. Others forbid drinking or recommend eating fat or butter in considerable quantities, thereby producing a species of satiety and destroying the appetite.

"Such treatments as these are, as a rule, either harmful, or quite impossible to carry out for any length of time. A more rational treatment, it appears, has been proposed by Dr. Robin, which is based on a number of seemingly well-founded scientific arguments. The *régime* laid down is somewhat as follows: (1) Breakfast at eight o'clock in the morning, consisting of a piece of meat, fowl, or cold ham, a small piece of bread (about fifteen grams), fresh fruit, and a cup of very weak and very hot tea, without milk and sugar; immediately after this meal take about at least half an hour's walk, but not enough to become tired or short of breath. (2) At eleven o'clock the second meal, consisting of one or two boiled eggs, two pieces of bread and a cup of hot water flavored with a little tea; after this a walk as before. (3) At half past twelve the third meal, consisting of cold meat, cold chicken, ham *ad libitum* (without sauce or mayonnaise); a plate of green lettuce, or the like, with a little salt and lemon juice, a plate of green vegetables, boiled in salt water, without butter or gravy. Fruit *ad libitum*, bread, fifty grams. For drink, a large cup of hot water flavored with a little tea. Rise immediately after the meal and take a walk of at least half an hour. (4) At half-past five, a large cup of hot water flavored with a little tea. (5) At half-past seven the same meal as at noon, to which may be added, if the appetite is very keen, some cold fish, or a plate of hot meat without gravy. This cure is continued until the weight is reduced, if not to normal conditions, at least to an improved state. It is interrupted, if any indications appear that it is affecting the patient harmfully. After the cure is terminated, the eleven o'clock meal is first of all omitted, and then gradually the *régime* may be abandoned, proceeding with prudence, and exercising greater rigor every time the weight is observed to increase.

"It is stated that with the above treatment much improvement is secured without inflicting upon the patient any unpleasant feelings of hunger or weakness."

Cost of Building Cheops

IT HAS been estimated that to rebuild the pyramid of Cheops under modern conditions an expenditure of $100,000,000 would be necessary and the labor of 40,000 men for two years required.

It has been calculated that the work really required the services of 100,000 men for thirty years.

The pyramid occupies a space of twelve and three-quarter acres and is seven hundred and forty-six feet high and contains about 143,315,000 cubic yards of stone and granite. The material alone represents an item of $36,000,000, while the labor would increase this amount by $72,000,000. To this must be added $3,000,000 for tools, transportation, and similar items.

The pyramid is built on a solid rock one hundred and fifty feet deep, and to build a foundation of this character would add to the cost to the extent of making the total of $100,000,000.

The Cry of the "Devil-bird"

OF all the awe-inspiring sounds emitted by wild creatures, none, it is said, is to be compared to that of the "devil-bird" of Ceylon, whose cry has been likened to the scream of a human being undergoing the most frightful torture. Naturalists have identified this bird with the brown wood-owl found in Hindustan.

The "devil-bird," or ulama, as the Cingalese call it, is an elusive creature. The natives of Ceylon regard the cry of this bird with superstitious horror, for, it is claimed, its scream heard at night presages the most dire misfortunes.

A British official of the Ceylon civil service has given some study to this curious bird. Its ordinary note, he states, is a magnificent clear shout like that of a human being, heard at a great distance, and producing a fine effect in the silence of the night. But the sounds that have earned for the bird its bad name, and which this officer reports he heard to perfection but once, are said to be well-nigh indescribable, the most appalling that can be imagined, and scarcely to be heard without a shudder. It has been compared to the cries of a boy in torture, whose screams are being stopped by strangulation.

[The Editor of the Home Laboratory will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

Etching Metals by Electricity

By A. J. Jarman

THE etching of metals by electrical energy does not seem to have received the attention it deserves. It must be borne in mind that wherever any chemical body is employed to perform etching, there also is electrical action.

Many times when etching by electricity has been attempted, the protective top bearing the inscription has been eaten away before any appreciable depth has been attained. This has been caused by the employment of an unsuitable etching fluid, or the protective top was not sufficiently resistant to the separated element or *ion* liberated by the electric energy. By a little study of the chemical bodies employed for etching either copper, zinc or steel, such as nitric acid, perchloride of iron, sulphate of zinc, and chromic acid, it has been found that these bodies are not the best suited for electrical etching. The real point to be considered is the effect of the liberated element upon the metal. Several solutions have been found that will answer the purpose well, and it is safe to predict that in due time the etching of metals by electric energy will become universal, because by the employment of electricity, it can be as readily ascertained how far the etching has proceeded, by noting the amperage and the time elapsed, or, in other words, *quantity* of electricity employed. This, according to Faraday's law, is proportional to the quantity of metal dissolved. By the electrolytic method one man could perform all the etching of six plates in the same time that it takes to etch one by the usual processes. For the protective top, any of the preparations may be used that are employed at present for ordinary etching, such as albumen, fish glue, enamel or bitumen.

For the information of those who are not acquainted with the above preparations it may be stated that the following will give results that can be depended upon, bearing in mind that where water is mentioned, *distilled* water is meant at all times.

SENSITIZING SOLUTION FOR ZINC.

The white of one fresh egg (albumen).	
Distilled water	6 ounces
Bichromate of ammonia	20 grains

Dissolve the bichromate of ammonia in two ounces of the distilled water. The remaining four ounces of water must be added to the albumen, which must now be well churned into a frothy mass for two or three minutes. Add two drops of strong aqueous ammonia to the egg mixture, using the egg beater, then add the bichromate mixture, beat again well, add half an ounce of pure photographic alcohol, using the egg beater again, so as to insure perfect incorporation. After the bichromate has been added to the albumen, the mixture becomes sensitive to light, and therefore all subsequent steps should be carried out in red light, or at any rate in subdued daylight. Allow the mixture to stand over night, then filter it through a tuft of absorbent cotton pressed lightly into the neck of a clean glass funnel, placing a flat strip of glass into a wide mouth bottle diagonally under the tip of the funnel, so that the sensitive albumen mixture falls drop by drop upon the glass strip. The object of this is to prevent the forming of air bubbles. The filtering must be conducted under a deep orange colored light.

If copper or steel is to be employed, the following mixture must be made:

SENSITIZING SOLUTION FOR COPPER.

Photo-engraver's fish glue	2½ ounces
Water	2½ ounces
Albumen (fresh)	½ ounce
Bichromate of ammonia	50 grains
Water	½ ounce

Dissolve the bichromate separately, add this to the fish glue and albumen. The mixture must now be well churned by a rotary egg whisk or beater, then filtered as described for the zinc sensitizer, but preferably twice. The etching solution must be made up, and kept in a glass battery jar. The etching solution given here is a special mixture for *electrical* etching only.

ETCHING SOLUTION.

A saturated solution of common salt, about	3 pints
Hydrochloric acid	2 fluid drachms
Water	5 ounces

This solution will keep well. The use of hydrochloric acid is to correct for the liberated sodium hydroxide which is formed by electrolysis; the liberated chlorine performs the etching, and combines with the zinc or copper, forming chloride of zinc or chloride of copper. In the case of steel, perchloride of iron is formed. Each metal must be etched in a separate solution. It will be observed that, after etching, the solution for zinc will remain white, that for copper will turn green, and the solution for steel will become a brilliant yellow. To perform the etching, an ordinary half-tone negative (reversed) must be employed, or for line etching an ordinary dense line negative, made by the wet collodion process.

Procure a few pieces of zinc plate about one-sixteenth of an inch thick, the same as used by photo-engravers. Carefully clean the plate by wiping it all over, back and front, with a warm solution of common washing soda. Rinse the plate in clean water, and allow to dry. This operation is simply to rid the surface of any greasy matter introduced by handling. The plate

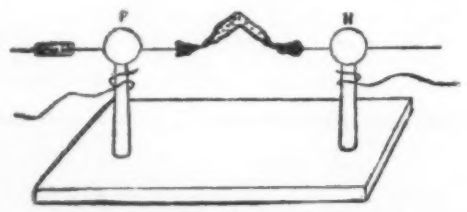


Fig. 1.—Electric etching in line on zinc.

First arc lamp, Sir Humphry Davy, 1808 From an old engraving, 1812.

must now be cleaned thoroughly, with fine pumice powder and water, by placing it face up upon a clean board, using a clean rag dipped into the pumice powder, and rubbing well up and down, not in circles. The plate must be reversed, so that the bottom end becomes the top, and the rubbing continued until, when washed with water from a faucet, the water will remain free and even all over, showing no greasy streaks or spots. Now drain the plate after it is well washed in running water all over, and pour a small quantity of the sensitized albumen mixture (under an orange light) upon one end of the plate.

Fig. 2.—Michael Faraday.

Halftone electric etching on copper. From an old photograph.

Tilt it so that the water is driven before the albumen, and allowed to run off. Drain the plate; then pour a small quantity of the sensitive mixture upon the opposite end and drain this off, allowing only a small quantity to remain upon the plate, which must now be gripped tightly at one corner by a pair of flat-nose pliers, and held level over the flame of an alcohol lamp, or small gas stove. Blow upon the surface with the breath, so as to aid evaporation of the water. Care must be taken that the plate does not become too hot, because this would cause the albumen to become insoluble. The plate now being dry, may be laid upon the negative, which has previously been placed in a photographic printing frame. A piece of felt is placed upon the back of the zinc plate, the back adjusted, and the springs, which should be very stiff, hitched into place. The negative must be allowed to rest upon a stout piece of flat glass in the printing frame. The frame can now be placed in the sunlight. If this is very bright, and the negative is a clear and brilliant one, the exposure will be about one minute and a half to two minutes. The frame must now be returned to a room illuminated by a deep orange colored light, the zinc plate removed, laid back down upon a stout sheet of glass, and a small India rubber roller, which has been carefully rolled up with a small quantity of lithographic ink, is passed over the printed surface of the zinc, rolling from front to back. The plate may now be reversed, and rolled until the surface presents a uniform gray coating of ink all over. Now place the inked plate into a tray of clean water, let it remain for five minutes, then take a tuft of wetted absorbent cotton, and carefully wipe the inked surface still under the water, when, if the exposure has been right, a beautiful print in minute dots or lines will present itself upon the surface of the zinc. The plate must now be removed, washed under the faucet, and carefully dried, then powdered all over with dragon's blood, the excess being removed by tapping the back with a sharp blow of a hammer handle, holding hammer head in the hand. The surface must now be lightly brushed with a flat camel's hair brush and the plate heated over a gas flame, until it begins to smoke faintly. Then lay it upon a piece of cold metal for about two minutes, when it will be ready for the etching bath. Two cells of the size and kind described in the SCIENTIFIC AMERICAN of May 28th, 1910, page 445, will form the battery for generating the requisite electrical energy.

The elements must be coupled in series, viz., the carbon of one cell connected by a piece of copper wire to the zinc of the next. A piece of sheet copper, zinc, or brass must be soldered to a copper wire and attached to the zinc cylinder of the free element. This will form the cathode. It must be remembered that electrical etching is the reverse of electroplating.

The piece of zinc bearing the ink image must be brushed over every part that is not to be etched, with either shellac varnish or a thin coating of asphaltum varnish, which is best done when the plate is warm. This protection will prevent the plate from being attacked, except where the required etching is to take place. The plate must now be attached to the remaining carbon element of the battery, by simply soldering a tin or brass garter clip to the end of a strip of copper wire, the right kind of clip being one of those with saw-like teeth. This will grip the plate perfectly, and allow easy removal. The plate, now being firmly gripped, must be quickly lowered into the salt solution. Instantly gas will be evolved from the cathode, while the metal exposed between the dots will begin to dissolve. After two minutes' action the plate should be lifted and examined, when in nine cases out of ten it will be found to be satisfactory. Dip the plate into the liquid again for three minutes, then remove it, and pour a gentle stream of clean, cold water over the surface. Now use a biconvex lens of about four-inch focus to examine the surface, when it will be found that for all ordinary printing purposes, the etching will be deep enough.

The albumen top will hold well in this etching solution, because it is well known that albumen becomes coagulated in a strong solution of common salt. If upon examination it is found that the etching is not deep enough, the plate should be very carefully brushed all over the surface with a flat camel's hair brush; then washed, dried and the ink roller carefully passed over the surface again; then warmed to partly set the ink, powdered again with dragon's blood, heated to melt this again, cooled off, and etched again for two or three minutes. As a rule, this second etching is not required. The surface must *not* be rubbed with absorbent cotton, because the edges of the etch are very sharp, and the fiber of the cotton will adhere very tenaciously. The plate may now be cleaned with either wood alcohol and ammonia, or if asphaltum has been used, benzine or turpentine must be employed to remove it. When the plate is cleaned, it can be trimmed at the edges, and pinned to a wooden block to make it type high, fitted in with type in the usual way, inked up and printed. If the etching is to be done upon copper, the fish glue enamel must be used, because it is better suited for copper than the albumen resist. Procure a piece of sheet copper the same as used by photo-engravers, that has been faced, polished and buffed. Clean it in the same way as described for zinc. Use

(Continued on page 177.)

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Electrified Artificial Rain for Agriculture

A New System of Irrigation

WE have had occasion in these columns to refer repeatedly to experiments carried on by Sir Oliver Lodge and others on the influence of electricity on the growth of plants. Mr. Emilio Olsson of Buenos Aires, Argentine Republic, at present in the United States, has, of late years, been giving his attention to the practical development of a process in which it is proposed to make use of electrified water for sprinkling fields. The inventor claims that his experiments demonstrate the practical utility of such a procedure. The benefits which are said to be secured are two-fold. First, there is a direct advantage to the plants, and secondly, Mr. Olsson states that according to his observations various harmful insects and other organisms are destroyed because of his process.

The need of artificial irrigation is severely felt in many places where, owing to the nature of the climate, long terms of drought have to be contended with. It is particularly in such districts as these that Mr. Olsson proposes to introduce his system, by the aid of which he expects to increase the crop and to combat effectually drought, insects and other troubles. The cost of the Olsson system is estimated at a figure which is quite moderate as compared with the benefits to be derived. The cost of installation for the sprinkling apparatus is figured at $50 to $100 per acre, according to local conditions.

The system is very simple. The water is raised to a suitable height by a motor or traction engine. The supply may be drawn from a river, stream, artesian well, or any other suitable source. Two high towers may be installed, from which pipes are suspended by means of suitable supporting cables. The pipes supply circular spray nozzles which revolve automatically, and five to ten acres of land can readily be thus supplied with an evenly distributed shower of water.

When it is desired to use electrified water, a reservoir is used, into which the water is pumped, to be subsequently distributed in the manner indicated above. The reservoir consists of an iron tank placed on an insulated support and charged from a dynamo supplying 0.5 ampere at 110 volts. The iron wall of the tank serves as positive pole; the negative pole consists of a copper wire insulated all except the tip. It is claimed that certain chemical reactions take place in the water, with production of oxygen, ozone, and hydrogen peroxide at the anode, and that certain of the products formed are beneficial to the plants. Mr. Olsson further suggests that this electrification of the water would tend to purify it and render it better adapted for drinking purposes.

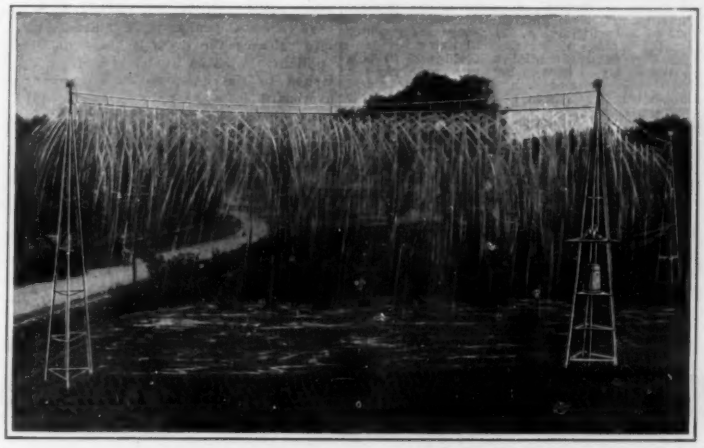
Mr. Olsson has installed his apparatus in a plantation near Buenos Aires and states that by the use of six sprinkling nozzles at a height of 5 meters above ground some six hundred acres of ground under cultivation were treated with very beneficial results. The apparatus has also been adopted by the municipality of Buenos Aires and is giving satisfaction in the public parks and gardens in that city. Mr. Olsson also states that during the long drought from which the republic suffered for over six months in 1910, he was able to produce a very fine crop of alfalfa and vegetables and to supply the owners of race horses with fresh fodder. By installing a system of artificial irrigation over some part of their crop, farmers should be able to insure themselves against drought, falling back upon artificial sprinkling in case natural rain fails.

Incidentally the interesting suggestion is made that the water line be used at the same time to carry the current for lighting and other purposes.

Mr. Olsson's invention has been protected by a number of patents, and the inventor has shown much perseverance in working out the details of his method.

Swedish Milking Machine

A MILKING machine has been developed in Sweden which imitates the process of hand milking as nearly as possible, that is by compressing the teat from top to bottom, but without drawing down upon it. Each teat enters a small metal box in which is a fixed rubber plate lying along one side of the box, while a movable rubber sheet is driven forward by two pistons, lying one above the other, so that the pressure is made first by the top piston and then by the bottom one, as in hand milking. After this, the pistons are thrown off by an automatic device and the process begins again. A funnel-shaped rubber bag takes the milk and it flows from here into a containing vessel of suitable shape. There is one front and one rear milking box and these are held in a forked support which is strapped to the animal. The rubber plates and bag are the only parts to come in contact with the milk and these can be very easily cleaned, so that there is no difficulty about this part. Any kind of an air compressor is used to operate the pistons and it is driven by electric motor or gasoline engine or even by horse drive. The air pipes are led along the stables and at each stall is a fitting upon which a rubber tube leading to the milker is placed. Two milkers can take care of eight or ten such machines for milking one hundred cows in two hours, where seven or eight milkers would be needed for hand milking. The animals do not seem to object to the machine and keep quiet during the operation.



Irrigation by means of electrified artificial rain.

In this new application of electricity, plant growth is stimulated by electrified water.

Mr. Olsson's experiments with well water as a conductor for illumination.

The pipes are insulated and buried in the ground. Inasmuch as there has been no evidence of electrolysis, Mr. Olsson believes that the electrolytic destruction of water pipes may thus be prevented.

Notes for Inventors

An Automatic Elevator-door Lock.—The Otis Elevator Company, as assignee of Axel Magnuson of New York city, has obtained a patent for operating apparatus for the locks of elevator doors, No. 998,624. The latch is associated with the door and its operating device is separate from and independent of the car and is automatically operated only when the car is opposite or near the door.

Westinghouse Turbine Patents.—George Westinghouse of Pittsburg has obtained patent No. 998,820 for turbine-blading, and No. 998,821 for a condensing-turbine. The turbine-blading includes in connection with the rotor having annular rows of blades, the stator, the blade carrying elements and circumferentially extending rows of stationary blades on the elements, the elements being mountable on the stator. The condensing-turbine is a re-entrant turbine in which the casing is divided into a stationary part and a cover and the fluid discharge devices are located entirely in the stationary part.

Coin-handling Machinery.—In a coin-handling machine, patented No. 998,830, to Universal Coin Wrapping Machine Company of New Jersey, as assignee of Chas. S. Batdorf of Brooklyn, is provided means for adjusting the coin-advancing and coin-wrapping mechanism to agree with the size of the coins to be wrapped and with the length of the packages.

A Peculiar Laminated Propeller.—Spencer Heath of Washington, D. C., has patented No. 998,897, a bladed propeller, consisting of interior laminations of soft wood, and exterior laminations of hard wood, with hard wood portions forming the extremities of the interior laminations.

Hair Washing Hoods.—Most women resent the difficulties and inconveniences incident to the washing of the hair by the ordinary processes. Orlando B. Salisbury of New York city has obtained two patents, Nos. 998,803 and 998,804, for hair-washing hoods. He provides a hood to fit the head and neck sufficiently large to inclose the hair and supplied with suitable means to admit and discharge the water and having, on its interior, flexible fingers which may be manipulated from the outside to aid in the washing operation.

An Old Patent on Cooling Houses.—Now that the subject of cooling dwelling houses in hot weather has attracted general attention largely through the ingenious efforts in that direction of Dr. Alexander Graham Bell at his Washington residence, it may be worth while to call attention to a patent, No. 246,781, issued in September, 1881, and now expired, to R. S. Jennings of Baltimore, Md., for an air-cooling apparatus which provided a cooling chamber having screens of fibrous materials arranged longitudinally and vertically and which, in practice, were moistened with a cooling liquid. The apparatus presented in this patent has a special interest since it was used in cooling the White House during the hot period when the wounded President Garfield lay suffering from the assassin's bullet, and the descriptive portion of the patent refers to "the use of the hereinbefore described apparatus at the Executive Mansion, Washington, District of Columbia."

Patents to Corporations.—Among the patents issued July 25th, 1911, are five patents and one reissue to the United Shoe Machinery Company, and eight patents to the General Electric Company.

A Negro Patent Examiner.—Henry E. Baker of Mississipp is the only representative of the colored race in the examining corps of the United Stated Patent Office. Mr. Baker is a second assistant examiner in the division of Principal Examiner Pond, who has the classes of bridges, hoisting, excavating, hydraulic engineering and metallic building structures, which includes, of course, structural iron working, and all allied arts. Mr. Baker, in addition to his duties in the Patent Office, is engaged in the compilation of a work in which he will be absolutely unique. He is the only individual who has a complete list of all the patents issued to negroes, and it is his purpose to embody them into a work of some sort, probably a book, giving a brief history of each inventor, the nature of the invention and the amount of success in the field of invention achieved by members of his race. The compilation of these statistics has necessarily been an arduous one, and has required an exhaustive correspondence with applicants and inventors in all parts of the globe. Naturally, many colored inventors fail to offer any evidence as to the race to which they belong, as that is not a requirement made of an applicant for patent. But through the courtesy of attorneys and the aid of his fellow examiners, Mr. Baker has been able to gather together what he considers is practically a complete catalogue of inventions by colored persons.

Billings Lectures on Patent Law.—The Hon. Cornelius C. Billings, First Assistant Commissioner of Patents, has accepted the invitation of the president of the Washington College of Law to deliver a series of lectures on Patent Office practice, before the classes of that college. Mr.

Billings is thoroughly conversant with every phase of procedure within the Patent Office. He commenced his career in the capacity of assistant examiner and has occupied every position in the office at one time or another. He became principal examiner by due course of advancement; was law examiner, examiner of interferences, acting examiner of trade-marks and designs, and a member of the board of examiners-in-chief. The present commissioner selected him for the position of assistant commissioner, and when the office of first assistant commissioner was created by Congress to meet the growing demands of the judicial branch of the office, Mr. Billings received the appointment. During the absence of Commissioner Moore in South America for four months in 1910, Mr. Billings was acting commissioner, so that the statement that he has filled every office in the Patent Office is specifically true.

Considering the duties which he discharges in his present place, in the hearing and deciding of appeals in patent cases, which decisions are final so far as the Patent Office is concerned, there is no doubt that his course of lectures at the Washington College of Law will be of the greatest interest and value.

A Commission for Supervision of Patents.—The Minnesota Electrical Association and the St. Louis section of the American Institute of Electrical Engineers have adopted resolutions petitioning President Taft to urge in his message to Congress the establishment of a permanent commission or department of the government for the supervision of patents and similar properties. It is thought that the functions of the Patent Office, as at present organized, stop short of that point where they could be of the greatest value to inventors, owners of patents and stockholders all over the country. The Patent Office has no control over patents after they are granted, and the electrical organizations named above, while recommending the establishment of a commission to supervise patents, trade-marks, etc., do not contemplate the robbing of the Patent Office of any of its existing functions. Rather there is a desire to increase those powers. Whether or not such a commission would savor of paternalism, it cannot be denied, but if, as contemplated, it should exercise a power somewhat similar to those of the Interstate Commerce Commission, much good might be accomplished in the business world. The preservation of the rights of inventors, manufacturers and investors through a supervisory board or commission would in all likelihood be preventive of fraud and infringement to a large degree.

Phonographic Advertising.—An advertising device, having an advertiser exhibitor and a phonograph to announce the adverti ement as it is displayed, is shown in a patent, No. 998,721, to George A. Stafford of Belcherville, Texas. It has a motor which, through suitable mechanism, operates to display advertisements successively and the motor also operates the phonograph to announce the advertisements.

Putting Out Gasoline Fires.—In our issue of July 15th, we stated that there was not yet a fire extinguisher especially adapted to put out fires "accompanied by the burning of gasoline or resultant gases." A manufacturer calls to our attention his own product, which is widely advertised, and which consists in excluding oxygen and preventing combustion. His is what he calls the "gas blanket" principle, applicable to all kinds of fires, even those of electrical origin. The substance which he uses is an absolute non-conductor with a dielectric strength of 500,000 volts per cubic inch.

Legal Notes

The Chartreuse Liqueur Case.—The Supreme Court, in an opinion delivered by Mr. Justice Hughes, has confirmed the right of the Charthusian monks in the well-known trade-mark for liqueur or cordial.

In reciting the facts, so far as the Court deemed it necessary to state them, the decision says that:

For several hundred years prior to 1903—save for a comparatively brief period following the French Revolution—the order of Carthusian monks occupied the monastery of the Grande Chartreuse, near Voiron, in the Department of Isère, in France. This was their Mother House. There, by a secret process, they made the liqueur or cordial which, at first sold locally, became upwards of fifty years ago the subject of an extensive trade and is known throughout the world as Chartreuse. The monks originally manufactured the liqueur at the monastery itself and later at Fourvoirie, close by. It was marketed here and abroad, in bottles of distinctive shape, to which were attached labels bearing the inscription "Liqueur Fabriquée à la Gde. Chartreuse," with a facsimile of the signature of L. Garnier, a former Procureur of the order, and its insignia, a globe, cross and seven stars; and these symbols, with "Gde. Chartreuse" underneath, were also ground into the glass. In 1876, the then Procureur registered two trade-marks in the Patent Office, and these were re-registered in 1884, under the act of 1881. In the accompanying statement the one was said to consist "of the word 'Chartreuse,' accompanied by a facsimile of the signature of L. Garnier," and the other "of the word-symbol 'Chartreuse;'" and the combinations in which these were used were described.

In the year 1903, having been refused authorization under the French law of July 1st, 1901, known as the Associations Act, the congregation of the Chartreux was held to be dissolved by operation of law, and possession was taken of their properties in France by a "sequestrating administrator and liquidator," appointed by the French Court. Forcibly removed from their former establishment, and taking their secret with them, the monks set up a factory at Tarragona, in Spain, and there, according to their ancient process, they have continued the manufacture of the liqueur, importing from France such herbs as were needed for the purpose.

The French liquidator, Henry Lecouturier, employing a skilled distiller and chemical assistants, undertook, by experimentation, to make at Fourvoirie a liqueur, either identical with, or resembling as closely as possible, the famous "Chartreuse," and, having succeeded in this effort to his satisfaction, he placed his product upon the market under the old name.

The liquidator's cordial was shipped to this country, and sold here in bottles of precisely the same description and with the same marks and symbols which had been used by the monks; if there was any difference, it is frankly stated to have been unintentional.

On final hearing the Circuit Court held that the registered marks constituted good and valid trade marks and the sole and exclusive property of the Charthusian monks or fathers. The Circuit Court of Appeals affirmed the decree with some modifications which affect only the paragraph containing the injunction.

In considering the argument that the mark is a geographical name, Justice Hughes says:

If it be assumed that the monks took their name from the region in France in which they settled in the eleventh century, it still remains true that it became peculiarly their designation. And the word "Chartreuse," as applied to the liqueur, which for generations they made and sold, cannot be regarded in a proper sense as a geographical name. It had exclusive reference to the fact that it was the liqueur made by the Carthusian monks at their monastery. So far as it embraced the notion of place, the description was not of district, but of the monastery of the order—the abode of the monks—and the term, in its entirety, pointed to production by the monks.

In considering the effect upon the U. S. trade-mark rights of the liquidation proceedings in France, the decision, after referring to certain House of Lords and Court of Appeals proceedings in the related case in England, says:

If, through his experiments, the liquidator had not succeeded in making a liqueur which resembled that of the monks, he would have had no business to transact so far as the liqueur was concerned, and the transfer, by operation of law, would not have availed to give him one. But the property in the trade-marks in this country did not depend upon the success of the endeavors of the liquidator's experts. The monks were enabled to continue their business because they still had the process, and, continuing it, they enjoyed all the rights pertaining to it, save to the extent to which, by force of the local law, they were deprived of that enjoyment in France.

The decision has a special interest in its bearing upon so-called geographical marks, for, after citing Canal Company v. Clark, 13 Wall. pg. 324; Columbia Mill Company v. Alcorn, 150 U. S. 460; Elgin National Watch Company v. Illinois Watch Company, 179 U. S. 665, the Court says:

"The familiar principle, however, is not applicable here;" and points out that "so far as it embraced the notion of place, the description was not of a district, but of the monastery of the order; the abode of the monks—and the term in its entirety pointed to production by the monks."

Recently Adjudicated Patents.—Out of ten adjudicated patents reported in the Patent Office *Gazette* of July 25th, 1911, eight patents were sustained by the courts, and infringement was found in four cases. One of these was in the case of the Gillette razor patent, No. 775,134, in Gillette Safety Razor Company v. Clark Blade & Razor Company (C. C.) 187 Fed. Rep. 149.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT.—S. TREINI, New York, N. Y. This garment is for use for bathing, athletic and other purposes, and is provided with an integral jockstrap, which can be conveniently opened and closed and when worn is practically concealed and not visible. For the purpose mentioned use is made of a suspensory band extending from the back of the garment and having its free end detachably connected with the free ends of straps or webbings attached to the rear of the garment.

Electrical Devices.

ELECTRIC BRAKE.—W. F. MOODY, Denver, Colo. This brake is of the kind provided with a flexible brake band. The invention provides in connection with the band a rocking member whose ends are connected with the ends of the brake band and braking force is applied to its middle portion, so that when the brake is set the position of the rocking member is changed by the tension of the brake band; one end of the rocking member acts for the moment as a fixed pivot and the opposite end pulls upon the opposite end of the brake band, so that the rocking member operates as a lever of the third class, and applies braking force effectively, with least expenditure of force.

Of General Interest.

DECK LASHING DEVICE FOR LIFE SAVING APPLIANCES.—F. ERIKSEN, 3 Taffelbays Alle, Copenhagen, Denmark. This device releases the deck lashings of life-saving appliances, such as life-boats and the like, well lashed to the deck, so as not to be swept overboard in a heavy sea, are so much the more difficult to release and it takes a longer time to do so in proportion to the firmness with which they are lashed to the deck. The invention has for its object the device that the boat or raft is safely fastened to the deck, but released automatically if the ship sinks, whereby the boat or raft floats.

CABLE CLAMP.—C. A. BUTLER, Bartlesville, Okla. This invention provides a clamp for quickly and readily attaching a releasing cable; provides removable jaws and special gripping jaws for varied employments, the jaws being universal for mounting in the clamp; provides jaws arranged for a multiplicity of adjustments to accommodate the use in conjunction with tables constructed of different materials; and provides an apparatus having an auxiliary clamp and holding device for the second line or cable.

ROCK LOOSENING AND IMPREGNATING DEVICE.—F. TRIPPE, Dortmund, Germany. This invention consists of a device adapted to tamp a bore-hole made in any rock or coal-stratum and to force any quantity of water pressure from an end portion of the bore-hole through the faults and crevices in the rock or coal stratum for breaking down or loosening the rock, while the water is prevented from escaping directly through the bore-hole to without.

FEED MEASURING APPARATUS.—J. J. SMITH, West Hoboken, N. J. The purpose here is to insure accuracy and economy in feeding stock, and to enable the quantity to be varied at any instant, yet made always definite and certain, so that on those days when draft animals are working and require full feed it may be readily measured, while on Sundays or other days of rest a smaller feed may be measured with equal certainty and with the same facility.

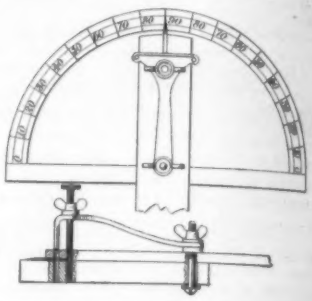
WHISTLE.—A. W. PROCTOR, New York, N. Y. This invention relates especially to whistles of the kind used as toys, the more particular purpose being to give the whistle such form as to facilitate its being held in position by aid of the lips and teeth of the operator. Further it relates to means whereby the sound may be so modified as to simulate the throbbing call of a bird, the throbbing to some extent under direct control of the operator.

PHOTO ENGRAVING DEVICE.—G. A. LEBEAU and R. R. THRESHER, Nashville, Tenn. An object here is to provide means whereby a negative having a better detail may be produced. A further object is to provide means for obtaining good strong solid dots in the blacks of the negative in a minimum of time. The device is simple in its nature and inexpensive.

Hardware and Tools.

LOCK.—RAFFAELE FEOLA, 2 East 120th Street, New York, N. Y. The object of this invention is to provide a lock which serves the purposes of the ordinary padlock, which, when in position, prevents the staples or eye-bolts from being filed or cut, and which renders difficult other unauthorized methods of opening the lock. His further object is to provide a lock in which the lock bolt proper is operated by key-controllable mechanism of the pin-tumbler type, which permits of a large number of vibrations on the key-controllable mechanism, and which may have the casing of different shapes adapted for use with different kinds of doors or other closures.

COMBINED PROTRACTOR AND T SQUARE.—FRANCISCO A. DEL CASTILLO, Washington, D. C. This invention has reference to drafting instruments, and its purpose is the provision of a new and improved combined protractor and T square, for the use of draftsmen, engineers and other persons, and arranged to permit of setting the blade of the square to any desired angle indicated on the protractor or to accurately fasten the blade in right-angle position relative to the base of the protractor. For the purpose mentioned in the foregoing use is made of a protractor (illustrated herewith), at the center of which is pivoted a blade, and an arm extends from the pivot of the blade and is provided with spaced pins straddling the sides of the blade, the pins also engaging apertures in the protractor.

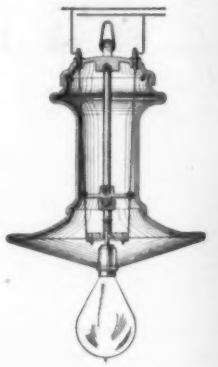


COMBINED PROTRACTOR AND T SQUARE.

Heating and Lighting.

ACETYLENE GAS GENERATOR.—L. E. BOSTROM, Ormond, Fla. The object of the invention is to provide a simple and efficient feeding device for acetylene gas generators, by means of which the carbid will be fed in small amounts to the generator whenever the pressure in the generator falls below a predetermined level.

ELECTRIC LIGHT FIXTURE AND HANGER.—FRANK P. HARRISON, Covington, Ga. The object of this inventor is to provide an improved means for suspending and protecting an electric light fixture or hanger. The fixture or hanger is suspended from and inclosed by a shield or protector to whose lower portion a lamp socket and a reflector may be conveniently attached. The details of construction, arrangement and combination of parts are illustrated in the accompanying engraving which represents a central vertical section of a lamp fixture and hanger constructed in accordance with the invention. The several parts of the interior portion are easily detachable from one another, which facilitates storage and transportation.



ELECTRIC LIGHT FIXTURE AND HANGER.

Household Utilities.

ATTACHMENT FOR INVALID BEDS.—JOSEPHINE M. SWENSON and T. S. OLSEN, New York, N. Y. The object here is to provide a bed which is inexpensive and simple, and which may be used as a foot rest or a seat to support the patient when the bed is raised, and the patient in an inclined position; as a back rest; as a table; as a protector to prevent an unconscious or delirious person from injuring himself against the head of the bed; and as a cradle for supporting the weight of the bed clothes.

Machines and Mechanical Devices.

UNIVERSAL RUDDER FOR FLYING MACHINES.—W. KRIEDTER and W. BOURDON, New York, N. Y. The more particular purpose here is to provide a rudder for service upon flying machines; that is to say, a rudder having a vertical movement for controlling altitude and a horizontal movement for controlling direction relative to the points of the compass—the rudder having surfaces disposed at different angles for enabling movements of the rudder to be effected.

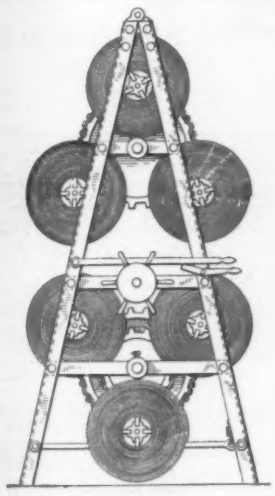
SEWING MACHINE.—J. L. KLEINMAN, New York, N. Y. In this instance use is made

of a thread case adapted to contain a spool of thread and a loop-taking hook mounted to oscillate on the peripheral face of the case to take hold of the needle thread loop and to carry the loop sufficiently far around the case for finally casting off the loop to form a lock stitch in conjunction with the spool thread.

TRIP MECHANISM FOR WELL SINKING MACHINES.—H. H. HAIGHT, Winnebago, Minn. This invention provides a mechanism for use in conjunction with the jerk line or drop cable used in a well sinking machine; provides a pulley for the said cable arranged to regulate the extent of the take-up of the cable, and provides a construction for the pulley and mounting therefor which is durable, simple and efficient.

DRIVING GEAR.—J. L. KLEINMAN, New York, N. Y. In this patent the invention has reference to pedal-actuated driving mechanisms, and the object is to provide a new and improved driving gear more especially designed for use on sewing machines and the like, and arranged to convert the oscillating motion of the pedal into rotary motion without undue exertion on the part of the operator.

BELT RACK.—ROBERT L. SMITH, Ninth and M Streets, Lincoln, Neb. The belt rack illustrated herewith in an end elevation occupies little room and carries many belts which may be readily moved to the desired position to permit of being unrolled. The device is constructed so that the belting is prevented from slipping from the spindles by the frame of the



BELT RACK.

device, it being possible to move the spindles to a position at which the belts can be readily moved. Means provide for locking the operating parts so that the spindles with belting may be held on a predetermined position relatively to the frame. Means provide for retarding rotation of the spindles carrying the belts. Also means by which rolls of belting may be wedged there around.

Prime Movers and Their Accessories.

PACKING.—P. S. TIBBILL, deceased; MAUD M. HEATH, Administratrix, care of Heath-Clark Co., Lyndonville, Vt. The object in this invention is to provide a packing, especially adapted for use with turbine engines, to prevent the escape of steam around the shaft, and also to prevent the entrance of air when the first stage pressure is below the atmospheric pressure, and which will not require any great amount of skill to fit, and when in place will not injure the shaft by cutting.

STEAM TURBINE.—J. BLAEKER, New York, N. Y. An object here is to provide a turbine with a rotor, to which the steam is admitted at the periphery and exhausted at the center, the rotor comprising a plurality of stages having gradually increasing steam passages advancing from periphery to center, with abutments increasing in size from periphery to center, so that the operating fluid, such as steam, as it decreases in pressure will have increased abutting surface to impinge on, thereby maintaining the turning moment uniform throughout the rotor.

MECHANISM FOR GOVERNING EXPLOSIVE ENGINES.—H. DE LAVALETTE, 175 Avenue de Choisy, Paris, France. According to this invention the governing arrangement acts on the two valves at once which are both operated; when the speed exceeds a predetermined limit a lever is automatically engaged by a centrifugal governor in such a position that it keeps the exhaust valve constantly open notwithstanding the action of its return spring and prevents the admission valve, which is normally closed by action of another spring, from being opened by the controlling mechanism.

Railways and Their Accessories.

DUMP CAR.—T. WALKER, Paris, Ky. In this invention use is made of a truck, a platform thereon, receptacles mounted to repose on the platform, means for raising the inner ends of the receptacles to tilt the same, aprons hingedly and adjustably mounted on the platform and adapted to slidably receive the material dumped, and auxiliary aprons for removable attachment to the said aprons.

Pertaining to Recreation.

GAME APPARATUS.—M. F. SHEA, Newport, R. I. This invention relates to games and has for its object to provide a device to be used as a counter or indicator with other games of chance or hazard. For this purpose use is made of a shell provided with a series of designating characters and a disk mounted to revolve in the shell when the shell is gyrated, the said disk having thereon an indicating pointer.

GAME PIECE.—C. SCHUTZ, New York, N. Y. This invention has reference to game pieces, the inventor's more particular purpose being to provide a game piece adapted to slide along a smooth surface, such as that of a board or table, the game piece being provided with a base and a rotund upper portion revoluble relatively to the base.

GYROSCOPIC TOP.—J. F. O'BRIEN, Jarbridge, Nev. The present invention includes several novel features and improvements in gyroscopic tops, one relating to the construction of the shell or hollow sphere in which the gyroscope proper is inclosed; another being the construction and arrangement of the trunnion bearings for the gyroscopic wheels. The sphere will have on its exterior a delineation of a map of the world.

Pertaining to Vehicles.

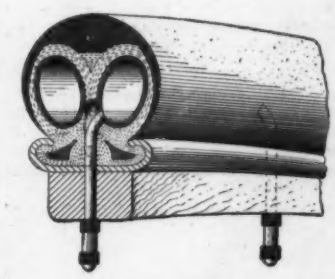
REFILLABLE BRAKE BLOCK.—J. H. SHELDON, Spokane, Wash. This improvement pertains to hollow or refillable brake blocks for use on wagons, or in places where a brake is customarily used. it provides an efficient brake block whereby surfaces may be replaced from time to time as they wear down. This is attained by positioning in a hollow frame or shell wooden blocks which may be replaced from time to time.

APPARATUS FOR BRAKING VEHICLES.—LOUIS BOIRAULT, 20 Rue Lafitte, Paris, France. This invention has for its object an apparatus for braking of the kind in which the application of the brake shoes to the wheels is obtained by the action of a cam fixed to the axle of a pair of wheels and acting upon an operating lever which is caused to approach or separate from this cam in accordance with requirements.

PUNCTURE CLOSING DEVICE FOR PNEUMATIC TIRES.—A. SMITH, Stuart, Neb. In applying the device to a pneumatic tire for the purpose of closing the edges of a rent, slit or puncture, the edges are drawn and held together, and the device is slipped over the same, so that the body portions lie on opposite sides of the slit and below the same. The device is then compressed and thereby clamped firmly in place by means of suitable pliers, the edges of the opening being thus clamped together and closed air-tight.

SPRING WHEEL.—J. B. DUNLAP, Tulsa, Okla. In this construction of wheel an ordinary wheel may be employed, and a rim is arranged around the wheel proper and spaced therefrom, and springs are arranged between the wheel proper and the spaced rim, and the springs are so connected with both the wheel proper and the rim as to secure an efficient resilient connection between the wheel proper and the rim, so as to avoid rigid connections which would tend to crystallization.

VEHICLE TIRE.—JOHN W. DRISCOLL, Box 143, Central City, Colo. This invention is an improvement in pneumatic tires, and has in view a tire having pneumatic tubes so arranged therein that the chances of puncture are remote, each tube being separate and independent of the other tube, so that the tire



VEHICLE TIRE.

is not rendered unfit for use should one tube be deflated, a tongue being provided between the tubes and arranged to serve as a support for the tread under such conditions. The body of the tire is constructed of the usual materials, such as rubber, canvas, etc. The illustration herewith shows a perspective view of a portion of a tire embodying the invention, the same being shown applied to the rim of a wheel and in cross section.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

INDUSTRIAL PLANTS. Their Arrangement and Construction. By Charles Price Day, New York: Engineering Magazine, 1911. 8vo.; 294 pp. Price, $3.

Careful study of the lay-out and construction of industrial buildings is the primary step toward efficiency and economy in manufacture. "Industrial Plants" is the outcome of Mr. Day's wide experience as consulting engineer in the construction of some of the most successful shops and factories in the country. His analyses follow a scientific method which takes into account not only the mere material factors of the problem, but which also looks ahead to the complexities introduced by the human element—the employees upon whom environment exerts so powerful an influence toward good or bad work, mental or physical. In this phase of the problem the field of the new "scientific management" is invaded. The discussion progresses from the broad general principles of lay-out and arrangement to a consideration of detail as required in specific instances. Charts, diagrams, and inserts point the lessons set forth. Further chapters bear upon the relationship between client and engineer. In "charcteristic modern examples" several large factories of varying types are pictured and described, and window-construction and painting are shown in their relations to adequate lighting. A large insert of a hat factory has red and blue routing lines showing the sequence of operations in the manufacture of hats. Metal-working shops are given considerable space, and the considerations bearing on machine-drive are featured in diagrams. The work will well repay a careful reading.

THE MUTATION THEORY. By Hugo de Vries. Vol. II. Chicago: The Open Court Publishing Company. 600 pp.; numerous illustrations, 6 colored plates. Price, $4.

It was our privilege to review, shortly after its publication, the first volume of this work, which is destined to take its place beside Darwin's "Origin of Species." That first volume was devoted to an elaborate discussion of experiments made by Prof. de Vries with Lamarck's evening primrose, and from the experiments made the conclusion was deduced that species may arise suddenly rather than by that age-long process for which Darwin argued. In the second volume, De Vries shows where the accepted Darwinian theory is wrong and where it will be necessary to substitute his own mutation ideas. Darwin himself foresaw the mutation theory, for he distinguished between the multiplication of his "pangenes" and their modification, and saw that without variation "natural selection could do nothing." With Darwin, variability of any kind supplies the field in which selection works and sinks to quite a subordinate position in comparison. De Vries, on the other hand, holds that specific characters do not arise by selection. An old-fashioned biologist may not be inclined to accept the mutation theory (and the more modern biologists are certainly in favor of it) he has at least shown the necessity of experimental study of species.

BUILDING FOR PROFIT. By Reginald Pelham Bolton. New York: The De Vinne Press, 1911. 124 pp.; 15 illustrations.

In this book the reader will find an effort to present scientifically the conditions which surround the planning, construction, and operation of a wide variety of metropolitan buildings during the last fifteen years. Here will be found the main features affecting and deciding values of improved real estate from the metropolitan standpoint, so that the investor may know what fundamental principles go to make or mar an investment, what conditions and methods will assist him in deciding upon the preliminary proportions of a structure in advance of expenditure, what factors must be considered in deciding on rates of depreciation, and what considerations must be weighed in rebuilding. The author has reduced his subject to mathematical relation to its parts, as far as possible, and has resorted to diagrams in order to afford ready reference to results. The subjects of the seven chapters which constitute the book are the following: I, Relation of Site and Building; II, Appreciation of Value of Land; III, Values Established by Building; IV, Depreciation of the Value of Buildings; V, Depreciation of Mechanical Equipments and Power; VI, Cost of Operating Buildings; VII, Manufacturing or Power Machinery.

CONSERVATION BY SANITATION. By Ellen H. Richards. New York: John Wiley & Sons, 1911. 8vo.; 305 pp. Price, $2.50.

Compiled from the experiences of the past twenty years, "Conservation by Sanitation" takes the position that sanitation is as much a paying proposition as a railroad or a machine shop. It concerns itself with three of our greatest modern needs—good air, good water, and the disposal of wastes. Under the present system of tight buildings, good air is by no means "free." Air supply costs the modern householder one-fourth as much as his food supply, although its charges are disguised under the names of "rent" and "fuel." The average man perhaps finds it easier to realize the good and evil potentialities of water. The author's facts and figures in relation to water supply—its efficiency, protection, and regeneration—are abundant and convincingly marshaled. The interdependence of town and country is graphically shown in the panoramic view of a stream's pollution. Succeeding chapters are devoted to ways and means of purifying water and disposing of contaminating wastes. In conclusion we are given a series of laboratory notes dealing with air and water tests and determinations. The volume is put forth as a laboratory guide, but it has a simplicity, sincerity and readableness rarely found in the exposition of scientific subjects, and the writer never loses sight of the vital relation of her mission to the welfare and advancement of the masses.

SCIENCE FROM AN EASY CHAIR. By Sir Ray Lankester, K.C.B., F.R.S. New York: The Macmillan Company, 1911. 423 pp.; 84 illustrations. Price, $1.75 net.

The volume before us is a collection of papers contributed by Sir Ray Lankester to the London *Daily Telegraph*. The modern thirst for scientific knowledge can be no better satisfied than by scientists themselves if they will only take the trouble to write down to the level of the great reading public. To be sure, popular treatment usually means such simplification of expression that it is difficult to maintain strict scientific accuracy. It is given to but few men to teach the multitude scientific truths in a way that the multitude can understand. If we may judge from this collection of essays, Sir Ray Lankester may be numbered among these. His essays are all of them so simply worded that any man with a high-school education can understand them. The variety of subjects is great, ranging as it does from biology to astronomy, from meteorology to chemistry, from paleontology to "death rates."

THE SUGAR INDUSTRY OF MAURITIUS. A Study in Correlation. Including a Scheme of Insurance of the Cane Crop Against Damage Caused by Cyclones. By A. Walter, F.R.A.S. London: Arthur L. Humphreys, 1910. 8vo.; 228 pp.; illustrated.

The work is in the nature of an investigation into what the author terms the "correlative coefficients" between the cane crop of Mauritius and the meteorological elements. The investigation falls naturally under two headings: First, as to a method of estimating the damage caused by cyclones, etc., and, second, a consideration of insurance against such damage. Matters have now progressed to the point where not only is an equitable insurance of the crop possible, but also an insurance of the profits. A brief history of the agriculture and commerce of the island is included.

HOW TO GROW VEGETABLES AND GARDEN HERBS. A Practical Handbook and Planting Table for the Vegetable Gardener. By Allen French. New York: The Macmillan Company, 1911. 8vo.; 312 pp.; illustrated. Price, $1.75 net.

This is a new edition of the book previously published under the title "The Book of Vegetables." The writer confesses that at the earlier stages of his career as a market gardener he might have avoided many costly mistakes and failures had such a reference book as this been in his possession. The seasons and methods given are for the northern United States and the latitude is that of New York. Each vegetable or herb is first described and its uses given, after which such points as soil, moisture, proper planting distances, and methods of handling are taken up. There is a table showing seed longevity and ounce values, and an index giving immediate access to any desired information.

MODERN GEOGRAPHY. By Marion I. Newbigin, D.Sc. New York: Henry Holt & Co., 1911. 12mo.; 256 pp.; illustrated. Price, 75 cents net.

"Modern Geography" is one of the issues of the "Home University Library of Modern Knowledge," a commendable effort to continue the educative work of the serious magazine article. After a short review of the beginnings of modern geography, surface relief and the process of erosion is studied, together with ice and its action. Climate and weather is the subject of another chapter, followed by studies in plant geography and animal life. This brings us to the most interesting division of the little volume—that dealing with the races of Europe and their origin. A discussion of minerals and their distribution in relation to industries and towns fittingly concludes the body of the work. A descriptive list of works of reference is an adjunct to be commended.

LE VITI MECCANICHE. Loro Calcolo e Costruzione. Manuale Teorico-Pratico ad Uso dei Capi-officina meccanici, Industriali, Capitecnici, Ingegneri, Insegnanti di tecnologie meccaniche nelle Scuole Industriali e d'arti e mestieri, Tornitori, Fabbri, Alunni di Scuole industriali. Milan: Ulrico Hoepli, 1911. 12mo.; 215 pp.; 110 cuts; 48 tables.

The title and the sub-titles form a sufficiently eloquent notice of the little work, which has the clear print and profuse illustration that distinguish the Hoepli handbooks.

William Napier Shaw

(Continued from page 165.)

For a decade and more the most promising investigations in meteorology have been those relating to the exploration of the upper air. Accordingly, we find that Dr. Shaw has taken a leading part in securing to Great Britain the enviable position she now holds in the field of "aerology." I need only refer to a recent publication of the Meteorological Office, "The Free Atmosphere in the Region of the British Isles," a large part of which was Dr. Shaw's individual product, to illustrate his and the office's activity in this field.

Another recent development of meteorology is the discovery of striking correlations in atmospheric conditions at points on the earth's surface far remote from one another. Dr. Shaw has, within this branch of the science, devoted special attention to the relation borne by the southeast trade wind to the other currents of the general circulation, and to the secondary phenomena connected with them. This led him a few years ago to the discovery of a remarkable parallelism between the fluctuations of this wind and those of the rainfall in southern England.

To the present writer meteorology appears to be just now entering upon an era of much enhanced prestige, due to circumstances that may be stated in the following syllogism: Aeronauts must cultivate meteorology. We shall all soon be aeronauts. *Ergo*, we must all cultivate meteorology, which henceforth must be looked upon as one of the most useful and important branches of science. Conversely, meteorologists must turn their attention to the problems of aeronautics. The director of the Meteorological Office is a member of the Advisory Committee on Aeronautics appointed in April, 1909, by the British government. The membership of the committee includes some of the highest scientific talent of England, with Lord Rayleigh as president. To its admirable report for 1909-10 Dr. Shaw contributes four memoirs on meteorological topics of interest to aeronauts; and in these memoirs he shows how fully he realizes and how unreservedly he accepts the new tasks of meteorology.

Besides the textbook of physics already mentioned, and scores of scientific papers and reports, Shaw has written a book on heat and one on ventilation. On the latter subject he is probably the highest authority in England, and he has been called upon, from time to time, to report on the ventilation of various public buildings, including the House of Commons. In recent years he has found time to deliver a number of lectures on meteorological subjects—as reader in meteorology at the University of London, and in other capacities—some of which are about to be published in two volumes entitled "Forecasts of Weather" and "The Climates of the British Possessions."

His academic honors include the LL.D. of Aberdeen, 1906; Sc.D., Dublin, 1908; Sc.D., Harvard, 1908; and Sc.D., Manchester, 1910. He is an honorary member of the Meteorological Societies of Austria, Germany and Mauritius. In 1908 he was president of Section A of the British Association. In 1909 he attended the installation of Lowell as president of Harvard University, representing his college, Emmanuel, which was also the *alma mater* of John Harvard. In 1910 he received the Symons gold medal of the Royal Meteorological Society.

The Knight Valveless Engine

(Continued from page 168.)

stroke of the motor the exhaust passage begins to open. The inner sleeve is moving down with the piston, and the passage is between the lower edge of the inner sleeve slot and the lower edge of the junk-ring in the head, the outer sleeve being practically stationary at the top of its stroke. The outer sleeve starts on its downward stroke, and, gaining in speed as the inner loses, leaves a clear opening for the exhaust. The piston is now one third up on its exhaust stroke, and the passage is closed by the upper edge of the outer sleeve slot in passing the lower edge of the exhaust port in the cylinder, as the piston reaches its top center. The four cycles or strokes of the engine(suction, compression, explosion, and exhaust) have now been completed; the crank has turned twice; the eccentrics have driven the sleeves once, and the cycle of operation is now ready to be repeated.

The timing shown is not different from that ordinarily used in poppet valve engines. Any timing of the valves can be secured, however, by varying the "lead" between the eccentrics that operate the two sleeves and by properly locating the slots in the sleeves. The amount of valve opening is practically unlimited and is governed by the width of slot in the sleeves and the "throw" of the eccentrics that drive and determine the travel of the sleeves.

This valve area need not be much greater than that of a poppet valve. The equivalent of increased valve area is gained, however, by the directness of the valve openings and the absence of restrictions in the gas passages made possible by this construction.

The fourth diagram of Fig. 2 shows that the compression space is contained entirely within the inner sleeve and that the fit or clearance between the sleeves has no effect either on the amount of the compression or upon the tightness of the compression space. The diagram also shows the general shape of the combustion chamber. It is evident that a minimum amount of surface is presented for the volume contained, so that the ideal spherical shape desired in gasoline motors is approximated.

The simplicity of the entire valve mechanism is apparent. The number of parts are few. All the working surfaces are cylindrical and consequently capable of easy and accurate machining. The bearing surfaces are large and easily fitted, and with a fair amount of lubrication should last indefinitely. The operation and movement of the parts present no new principle in mechanics.

The operation of these sleeve valves is absolutely quiet, accurate, efficient, and absolutely independent of the speed of the engine, which last feature is in great part responsible for the improved performance of Knight automobile motors.

A test of two motors identical except for the valve mechanism will show a certain decided increase in power in the sleeve valve motor, an increase in power which becomes more and more apparent as the speed of the engine increases. At low speeds the difference is not noticeable, for the cam and spring operated valves are then at their best. At high speed, however, the action of the poppet becomes very uncertain and the "timing" is uneven. The sleeve valve is not affected by high speed. The resistance offered to the passage of exhaust and inlet gases by the shape of the poppet valve openings is far greater than that of the sleeve valves. This limits the power output of the poppet valve motor.

Continued use of the Knight motor seems to improve it. The sliding sleeves apparently lap themselves into a better working fit. The lips of the slots in the sleeves remain clean and no difficulty in the lubrication or cooling of the motor is likely to develop.

The lubrication is generally effected by a splash system. In other words the oil is lifted from the base of the engine by the connecting rods and thrown upon the walls of the piston and sleeves. The sleeves are generally provided with a number of oil grooves, and the oil is lifted both by the wiping of the surfaces and the suction of the motor.

The cylinders are cooled by water. The usual centrifugal pump circulates water, through the water jacketing of the cylinder and down into the water-jacketed head.

The motor here shown is of 4¼-inch bore by 5½-inch stroke. The travel of the sleeve is 1⅛ inch.

There are now upward of six thousand of these Knight type motors in successful operation and their development and manufacture in this country will be watched with interest.

Lessons of the 1911 International Cup Race

(Continued from page 170.)

The central frame, very deep at the front and of a significant fusiform shape, is entirely covered with fabric, reducing the air resistance immensely but adding in skin-frictional resistance. The shape of the body in section is rectangular, thus giving a large area of vertical and horizontal surface to aid in turning and in maintaining any given direction. Weymann and the other Nieuport pilots were able to negotiate the sharp turns with more ease in a calm than in a wind but were never able to attain the degree of "banking" repeatedly exhibited by the Wright. The large area of "directive" surface given by the body, would prevent any such sharp pivoting as is obtainable with the Dayton product.

The shape and sections of the plane are given in the diagrams. The entering edge of the plane profile is smooth and lacks any pronounced dipping. The plane is thinnest at the outer ends and thickest near the center of each wing—a curious feature that adds considerably to the strength.

The disposition of the seat in the frame and the shape of the rudders and tail are evident. The fixed semicircular tail surface is non-lifting and in fact is at a slight negative angle when the machine is in full flight. The two semicircular flaps at the rear of it constitute the elevation rudder and are operated by the forward-back motion of a large control lever. This same lever, when moved from side to side, operates the small single rudder for direction situated at the extreme rear.

The most noticeable and admirable feature of the entire design is the extreme reduction in the number of stay wires and projecting spars. Outside of the body the only source of pure head-resistance is a four-piece mast to which the planes are braced and the simple chassis. The latter consists merely of a strong ash frame and skid and two wheels mounted on a laminated steel spring—a magnificent combination of simplicity, utility, and strength.

The planes are double surfaced, 28 feet in span and with a chord measuring 6 feet 10 inches at the body, gradually decreasing to 5 feet 8 inches at the tips. The plane is warped for transverse control by means of a foot yoke actuating the inclined rod appearing on the chassis and to the ends of which the warping wires are attached.

The entire length of the machine is 25 feet.

The surface area of the supporting plane is in the neighborhood of 150 square feet. The weight with operator and fuel as flown in the race was nearly 700 pounds. This gives a loading of 4.66 pounds per square foot. The aspect ratio is roughly 5 to 1.

Weymann flew his Nieuport tail-high at an extremely low angle of incidence, often 1 degree or less—an interesting and suggestive fact.

THE BLÉRIOT XXIII.

This racing type of Blériot flown by Hamel and by Leblanc was originally about 22 feet in span. But at the last moment M. Blériot deemed it wise to clip the ends of the wings, finally reducing the span of the machine used by Leblanc to almost 17 feet. The chord of this type measured 3½ feet, so that the surface area was in the neighborhood of but 60 square feet! This is less than the area of the elevation rudder, alone, on the old 1909 Wright biplane.

The appearance presented by this machine was in consequence little short of ridiculous. At the front end of the long tapering frame was mounted the 100 H.P. 14-cylinder Gnome engine driving a Regy propeller, the same kind of power plant used by Weymann.

Major Squier once defined the limit of the aeroplane as a helicopter flying horizontally; M. Blériot is evidently aiming for this goal—with what success remains to be seen.

The entire length of the apparatus was about 24 feet. The rudders at the rear and the warping were operated by the usual Blériot "cloche" and pedal system.

The weight with aviator aboard was nearly 550 pounds, thus giving a loading of over 9 pounds per square foot of surface, the high-water mark in aviation. The angle of incidence used in flight by Leblanc was much higher than that of Weymann—approximately 7 or 8 degrees.

In straightaway flight the speed of Leblanc is said to have been tremendous, but on turns he was forced to go so wide that he lost ground, and eventually the race. Hamel, lacking the expert-

LEGAL NOTICES

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Inquiry No. 9246.—Wanted, addresses of parties having raw materials or minerals containing potash in any form.

Inquiry No. 9247.—Wanted, to buy a Parmelee aerated water.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

ness of Leblanc, came to grief on the first turn, being unable to recover from the inclination because of the inadequacy of his supporting surface. This is a feature for which this type deserves to be severely criticised. It merely points to what an absurd sacrifice M. Blériot went to gain a little in speed.

THE WRIGHT BIPLANE.

This "Baby" type is already familiar to many, and will be recognized as a counterpart of the small machines flown at Belmont Park last year. Mr. Ogilvie used an N. E. C. engine rated at 50 H.P. and with it attained a speed only slightly greater than with the 30 H.P. Wright engine used by him last year.

The biplane measured 21½ feet in span, and 3½ feet in depth. The total area was 145 square feet. The aspect ratio was over 6 to 1, and the loading about 6 pounds per square foot.

The rudder and control systems are precisely the same as on all the standard Wright types.

Mr. Ogilvie introduced an innovation in fixing to the next to last strut near either end of the main biplane cell, single vertical surfaces, to act as keels. These doubtless added to the resistance but Mr. Ogilvie found that they aided in steering.

The noticeable fact about this machine in flight was the manner in which it appeared to "drag" as compared with its swifter competitors. This in a measure was due to its lower power, but more particularly to its very much higher resistance.

The main features in which the types differ may be summed up as follows: The Nieuport had a light loading and a very small angle of incidence, which, added to the small resistance of the framing, made the total resistance to be overcome by the propeller thrust very small. The Blériot had a high angle of incidence, a frame of considerable resistance, and a very small surface. The power plants being the same, it is evident that the Blériot, with almost only one-third of the surface, offered as great a resistance to motion as did the Nieuport. This does not only speak well for the Nieuport but badly for the Blériot.

The Wright was lower powered but had a medium loading with a very high framing resistance.

COMPARATIVE FEATURES.

The sections of the planes of these three types are given. M. Eiffel in his classic experiments has investigated all these sections. For the Wright, the best ratio of lift to drift is obtained in the neighborhood of 2 or 3 deg.; for the Blériot at 3 deg. and for the Nieuport at 6 deg. The normal angle of flight of the low-powered Nieuport is at 6 deg.—the most efficient one. Any higher power for the same weight, results in higher speed only upon reducing the angle of incidence. The speed does not increase proportionally with the horse-power. Upon using a 100 H.P. motor—as did Weymann—only a slight increase of speed is attained over a 70 H.P. Since he appeared to be flying at as low an angle as possible, the conclusion is at once drawn that for lifting this particular weight of machine a limit has been reached. Upon further increasing the motive power, to offset the tendency the machine would have to ascend, it would almost appear necessary to actually add weight to it, to hold it down. This merely emphasizes the precise balance that exists in aeroplane design between weight, speed, and power.

M. Eiffel's investigations show a particularly interesting difference in the aerodynamics of these types. On the Wright, he found the distribution of pressure to be very high at the extreme entering edge region of the plane, the pressure decreasing in intensity toward the rear. On the Blériot the total pressure, suction on the upper face and pressure on the under face, was a maximum at one-fifth of the chord from the leading edge, but as on the Wright, decreased sharply toward the rear. On the Nieuport, a different situation was found. The pressure was a maximum much nearer the center of the plane, sloping easily to the front and the rear, thus indicating a far more uniform intensity and distribution of pressure. This has a great deal to do with explaining the high efficiency of the Nieuport product.

LESSONS OF THE RACE.

What the Wright gained in strength and stability it lost in its inherently higher resistance—at once stamping the biplane as a slow-speed machine.

The monoplanes at last proved themselves beyond doubt the ideal type for rapid flying. Two important considerations result from actual observation of the flight of Weymann's Nieuport and Leblanc's Blériot. Had Weymann had less surface on the straight stretches he could have attained a much higher average speed, but at the turns in order to "bank" with a proper degree of safety and rapidity he needed every square inch of surface he had. On the other hand Leblanc had about as little surface as possible for straightaway flight, but on turns he was forced to go far out of his course and skid to an alarming extent. Had Leblanc been provided with more surface at the turns he could have "banked" more sharply and thus greatly increased his average speed. The two facts point unerringly to the immense advantages that would be possessed by a machine with variable surfaces—reduced to a minimum in straight flight, and spread to a maximum in landing, starting, and negotiating sharp turns. Never before has the real significance of the variable surface aeroplane been more powerfully suggested—a key to still faster flight.

The important and pronounced characteristics exhibited by the machines in making sharp turns should permanently fix these as one of the characteristic requirements of the contest. To further test the machines more difficult maneuvers should be made imperative, such as clearing certain altitudes and turning both to right and left.

In addition to this time should be taken from standstill to standstill, thus bringing into the contest the highly important elements of starting and alighting. It is not unlikely that the 1912 cup race will see speeds of 90 miles an hour reached and perhaps surpassed.

Etching Metals by Electricity

(Continued from page 172.)

the fish-glue preparation in the same way as the albumen, draining the excess only partially off the plate. Then insert it in a whirler, spin this around at a moderate speed over the flame of a gas stove, about one foot above the flame. In the course of about two minutes the plate can be removed from the whirler, stood on end to cool, then placed upon a negative that has been made with a screen of about 100 lines to the inch. The pad of cardboard is now placed upon the back of the plate. The back board is inserted, and fixed with considerable pressure so as to insure complete contact. Now place the frame out in the sunlight. An exposure of from two to five minutes will be required. Take the printing frame to the dark room, remove the plate under an orange-colored light and pour over it a solution of aniline violet in water. A teaspoonful of the dye to a pint of water is about the right amount. Drain off the dye and allow a very gentle stream of water to flow over the plate. Wipe the surface with a tuft of wetted absorbent cotton; this must be done with great care, and a very light touch. The image will now appear in beautiful violet dots all over the plate, which must be allowed to drain and dry, or it may be replaced in the whirler, and dried in the same manner that was used to set the sensitive coating. The image must now be burnt in. Take the plate, grip it with a pair of flat-nose pliers at one corner, hold it over a gas-stove flame, turned down rather low. Turn the plate around, keeping this up until the image seems to disappear. Continue the heat and motion until the image turns to a medium chestnut brown. Remove the plate at this stage, brush the back and edges all over with asphaltum varnish, allow to cool, when it is ready for the etching. This must be carried out in just the same way as for zinc, using a separate bath of salt and acid, while the time for etching will be about the same as for zinc. This protective top is called enamel; it will resist the etching liquid perfectly. If the etching is to be made in very fine dots, only two or three minutes is necessary, when the face can be brushed well over in clean water, the asphaltum varnish

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One part of our trade is drawn from the *car manufacturer* who makes a good, reliable car—and who refuses to be influenced by the fact that "he does not make it and is thereby not responsible," to equip his good car with an inferior and unreliable speed indicator.

Such manufacturers either equip with the Warner or insist that their dealers and agents recommend it as of even quality with their car.

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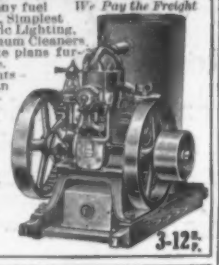

3-12

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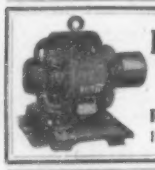

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removed, as in the case of zinc, the plate trimmed and mounted in just the same way upon a wooden block. The current used in this case, generated by the battery described, will be about three or four amperes, and the electromotive force three volts.

Fig. 1 of the illustration was etched as described on zinc, and Fig. 2 upon copper.

The Current Supplement

WE have had occasion recently to discuss in our columns the extension of docking facilities for the port of New York, rendered imperative by the ever-increasing size of trans-Atlantic liners. This week's issue of our SUPPLEMENT, No. 1859, brings an account of the steps taken at Southampton by our cousins across the sea to face the situation. Our English correspondent writes on the new docks in the course of construction for the White Star Line.—The readers of the SCIENTIFIC AMERICAN are familiar with the Soya bean. This remarkable seed yields a "vegetable milk," from which may be derived, as from animal milk, a cheese and a species of casein. These points and others are dealt with in an article on the "Extended Utilization of Soya Bean Products."—An illustrated account of the methods employed in measuring radio-activity is given by André Conte.—The fourth instalment of Donald Murray's valuable article on Printing Telegraphy appears in this issue.—How much money is lost to railway companies by locomotives held up in the repair shop is the question dealt with in an article entitled "What is a Locomotive's Time Worth."—The dimensions of the M'Adoo tunnel impose certain restrictions upon the cars operated therein. These cars are illustrated and described in a special article.—It is extremely difficult to extinguish fires in such inflammable liquids as kerosene. What can be done by spreading a blanket of foam over the surface of such burning liquid is described in an article from *Prometheus.*—W. A. DuPuy gives an account of Dr. L. W. Austin, Government Expert on Radio-Telegraphy, and his important achievements.—E. F. Harran, of the Calcutta Port Commission, writes on the Indian tea trade.—An illustrated article is devoted to "The Influence of Erosion by Water in Modeling the Landscape."—Some notes on "Underground Water for Public Use" are cited from a recent pamphlet issued by the United States Geological Survey.—Prof. Charles E. Munroe writes on "Our Dependence upon the Nitrate Supply for National Defense."—Prof. Dobereck speaks on the subject of "The Proper Motions of the Fixed Stars."

Cuttlefish Farms

AT several points on the British coasts there are located cuttlefish farms, where the little creatures are kept in tanks or ponds to be "milked" of their ink.

The pond or tank is connected with the sea by a pipe, and a thousand or more cuttles are kept in a single one. They present a curious sight as they move about, trailing their long arms and staring out of their bulging eyes.

They are guarded by screens with a view to preventing fright, for, if they are suddenly scared, they will emit their "milk" in the water, a dead loss to the cuttlefish farmer. The fluid, or milk, is very valuable, and each cuttle will yield about $2.50 worth a year. It is secreted in a bag, which can be opened and closed at will, the cuttle ejecting the fluid to darken the water so that it may escape unseen when attacked.

The best cuttlefish are obtained in China, where for some reason or other, they produce the best quality of "milk."

When the farmer considers it an opportune time to milk the cuttles he proceeds by opening the sluices of the ponds and gently agitating the water. The cuttles then swim around the pond, and as soon as one passes through the sluice is closed. The cuttle passes down a small channel into a basin or metal receptacle, and as soon as it is securely there the water is drained off. It is then frightened, and at once squirts the fluid from the bag. When it is exhausted it is lifted out, the milk is collected, and the basin is prepared for another.

Notes and Queries.

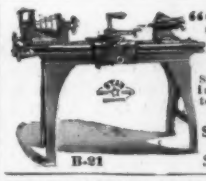
Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12518) S. R. W. asks: In your Railroad number I note in one of the articles (page 590) that reference is made to the fact that in some instances the train dispatcher is able to communicate with the conductor of the train by telephone. Will you please inform me as to the construction and methods employed in this system? A. Communication was made with moving trains a good many years ago. A system which bears the name of Mr. Edison has been used. It employs the induction of the current to produce a current in the telephone circuit on the car of the train. The main circuit is by the side of the road. The receiving circuit is on one of the cars of the train. The induction of the current in the main circuit is sufficient to generate a current in the circuit on the car, and thus enable one to hear the message. By the same means a message can be sent from the train, and these circuits have been used by passengers to send and receive messages *en route.*

(12519) A. H. M. asks: In regard to query 12470 of June 24th, 1911, issue, I would like to state the following: It is a well-known fact among those who have seen service on submarine vessels, that it is possible to balance a submarine boat at any desired depth. The greater the depth at which it is desired to balance the boat, then the greater the amount of negative buoyancy (in the form of water ballast) which must be carried. From this it would be inferred that the density of sea water bears a certain relation to the depth of the water, and I am of the opinion that lack of circulation as the depth increases naturally results in greater concentration and density. Theory leads us to believe that an object that is heavy enough to sink will continue to sink to the bottom, but the fact that water is not throughout a medium of uniform density is often not considered. A. The compressibility of water is about 1/22000 part per atmosphere, and an increase of one atmosphere is had at about 33 feet below the surface of the sea. From this statement it is not difficult to calculate the number of pounds of water ballast required by a submarine of known volume and weight to balance the increase of buoyancy due to depth. This is, however, not the question in the query referred to. The fact is that if a heavy body sinks in water, it will continue to sink till it reaches the bottom if its weight is not changed. This the submarine would do if its weight was not changed by changing the quantity of water in it. The difference in density due to the quantity of salts dissolved in the water is not great at different places and does not affect the result to any great extent. The continuous sinking of a body in the sea is due to the fact that it is compressed more and made denser by its deeper submersion than the sea water is at the same depth. The submarine is not compressed in sinking to ordinary depths, but its volume and weight are changed by admitting water to make it sink and removing water to make it rise.

(12520) R. E. T. says: My house is frame with slate roof. I use electric light 115-volt old-style two-wire system, with the wires entering at the top of house. The wiring was put in some years ago. Would it be better to throw the main switch during an electrical storm or not? One side of the transformer is grounded, and I have combination gas and electric fixtures. A. If you have not a good lightning arrester at the point where the electric wires enter your building, you would better have one put on without delay. Even after this is done, the house is better protected from lightning if the main switch is open during a thunder storm. In some places the switch at the generating station is opened during a thunder storm and all lights are cut off.

(12521) E. P. says: I am experimenting with electricity, and use a lot of dry cell batteries in my work, and I find it very expensive to buy new batteries. Won't you kindly tell me a way by which I can restore my old batteries again? A. We regret to have to say that there is no way of fully restoring old dry cells. They are generally thrown away when exhausted. Some have punched holes in the zinc cases, and put the whole in a glass jar with a solution of ammonium chloride. They will then give some more service, but not enough so that the operation is profitable. Some have dug out the top and soaked the cell in the ammonium chloride solution. This is the better way. If time and labor are of little value, one can perhaps profitably work on old dry cells; otherwise, not.



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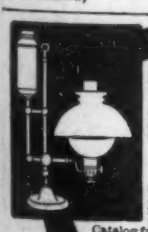

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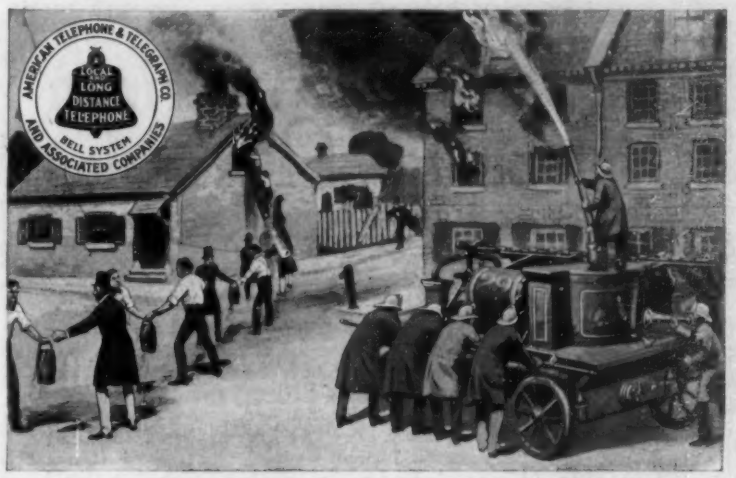
Aeronautic Notes

Current Aviation Meets.—The first big aviation meet of the present year in the Middle West opened on the 12th inst. in Chicago. Over twoscore aeroplanes of different types, piloted by the leading American aviators, were entered, and $80,000 in prize money was competed for. The meet was held at Grant Park on the shore of Lake Michigan, which, though a windy spot, did not affect the flights materially. The first big meet of the year in the East opens at Boston on the 26th, while a second Western meet will be held at St. Louis, beginning September 30th.

Big Prizes for Cross-country Flights.—The offer of $10,000 to Harry Atwood for a 1,000-mile cross-country flight, which is said to have been made recently by a prominent patent attorney of Washington, has caused this daring aviator to attempt a flight from either Milwaukee or St. Louis to New York in the near future. A prize of a like amount has been offered by Gen. Charles M. Taylor, the proprietor of the Boston *Globe*, for a 150-mile interstate monoplane circuit race during the Boston meet. This is the second $10,000 prize donated by General Taylor, as he gave a similar amount a year ago for a flight from the aviation field at Squantum to the Boston Light and return. This prize was won by Grahame-White with his Blériot monoplane. A prize of $7,500 has also been put up for biplanes to race over the same course on September 2nd. The cities included in the circuit are Nashua, N. H., Worcester, Mass., and Providence, R. I. The $10,000 will be divided into three prizes of $7,500 $1,500 and $1,000, respectively, while in the biplane race the prizes will be $5,000, $1,500 and $1,000.

The First Inter-city Aeroplane Race.—The first aeroplane race across country from New York to Philadelphia was flown on Saturday, August 5th, when Messrs. Beachy, Ely, and Robinson of the Curtiss force started from Governors Island, flew up the Hudson to Thirty-third Street, circled over the roof of the Gimbel building, and headed for Philadelphia. Beachy, who has already made a name for himself by his flight over Niagara Falls a short time ago, won the race, his time from store to store for the 90 miles being ¾ minute less than two hours, including a stop at Trenton, in order to take on fuel. Robinson was second in two hours and one-half, while Ely only got as far as Princeton Junction. Just before reaching Philadelphia Beachy passed into a shower and was thoroughly soaked ere he circled above the Gimbel building in Philadelphia, saluted the statue of William Penn on top of the City Hall, and landed in Fairmount Park. Notwithstanding this fact, he gave a fine exhibition flight while waiting for his brother aviator. All three aviators used Curtiss 50 horse-power biplanes having 8-cylinder V-type motors. The prize was $5,000 in cash. It was put up by the Gimbel firm with an idea of encouraging cross-country inter-city aeroplane racing.

A New Distance Record for the Michelin Trophy.—M. Vedrines, the winner of the Paris-Madrid race, made a trial for the Michelin trophy on the 9th inst. in France, and succeeded in covering 800 kilometers (497.09 miles) in 7 hours, 56 minutes, and 36 seconds. This corresponds to an average speed of 62½ miles an hour, which is excellent for a sustained flight over a closed circuit. This new record supplants that made by M. Loridan of 469 miles in 11¾ hours on the 21st ult. The new record was made with a Morane monoplane instead of with a Farman biplane which was used by M. Loridan. In competing for the trophy this year the flight must be made across country, back and forth between two points from 50 to 100 kilometers apart. Competitors may descend as often as they please to take on fuel or make repairs, but no part of the machine can be replaced that is sealed by the officials. An average speed of 50 kilometers (31 miles) an hour must be maintained. The winner of the trophy this year will be the pilot who, before November 1st, has covered the greatest distance over a closed circuit. This distance must exceed the 582.935 kilometers (362.21 miles) scored by M. Tabuteau last year.



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President of Johns Hopkins University, will tell in the Scientific American for next week how the

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came to be appointed, explaining certain facts not generally known to the public. This article was prepared for the September Magazine issue and in its place, President Remsen will write for that issue on Artificial Rubber.

Next week's issue will also contain an appeal to farmers to

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